Science Progress.

No. 12. FEBRUARY, 1895. Vol. II.

VARIETIES OF LEUCOCYTES.

PERHAPS recently more than ever has minute attention been given to the structure and behaviour of wandering or free cells, and many of the problems offered by the leucocyte have become familiar to every anatomist and physiologist. It may be useful to attempt a succinct description of some of the recent facts elicited, and of the views enunciated by various authorities.

By "leucocyte" it is now customary to mean any vagrant cell of the organism, not merely a cell whose habitat lies in blood and lymph, but also the cells which haunt the serous (cœlomic) chambers and the intercellular interstices of the tissues. It was at one time tacitly assumed that the wandering cells in each and all of these localities were actually identical (1). It is now well recognised that between the wandering cells in various localities considerable and specific differences exist; and that even in one and the same locality a mixture of wandering cells distinctly differing one from another in morphological characters co-exists, although at the same time each of the various cell-forms appears to possess a region of distribution more or less proper to itself, a habitat of its own.

The varieties of leucocytes now generally recognised to be separable are the following (2):—

I. The lymphocyte or small hyaline cell.

II. The large hyaline cell.

III. The finely granular oxyphil cell.
IV. The coarsely granular oxyphil cell.
V. The finely granular basophil cell.
VI. The coarsely granular basophil cell.

The following is a summary of the characters made out for each of these several varieties.

I. *The Small Hyaline Cell.*

About the same size as a human red blood corpuscle, this cell is often termed "lymphocyte" because so numerous in lymphoid tissue, *e.g.*, lymph glands, tonsils, etc. Its scanty cell-substance appears quite devoid of granulation. Its nucleus is spheroidal and deeply tingible. The cell does not exhibit amœboid movements, nor does it readily adhere to surfaces as do many of the wandering cells. It does not appear to have the power of ingesting particles, and therefore cannot be included among "phagocytic" cells. The birthplace of this cell lies undoubtedly in the lymphoid tissues, probably in lymphoid tissue of all kinds; the production of it takes place especially at the "germ-centres" of the lymphatic tissue where mitotic figures are always abundant (3); and in the lymph issuing from the active tissue young cells abound. The small hyaline leucocyte is probably to be considered in all cases as a young cell—an immature form. Into the blood it finds its way almost entirely *via* thoracic duct. In the blood it is not the most numerous form of leucocyte; its numbers there are subject to phasic variation, becoming highest two to three hours after the ingestion of a full meal, and then forming even as much as a third of all the wandering hæmic cells, and numbering about 2500 lymphocytes in the cubic millimetre of blood. In lymph from the thoracic duct it is much more numerous absolutely as well as relatively to other leucocytes; there not uncommonly 25,000 lymphocytes per mm^3 of lymph can be estimated, and they form more than 90 per cent. of all the cells in the lymph. In "lymphatic leukœmia," a diseased condition characterised anatomically by enlargement of the lymphatic glands, the normal number

of small hyaline leucocytes in the blood is usually very greatly exceeded.

II. *The Large Hyaline Cell.*

A spheroidal cell with a rounded, often reniform, nucleus. The nuclear network consists of very fine chromatin threads enclosing relatively wide meshes; as a whole, therefore, the nucleus does not usually take on any great depth of stain. So long as the cell remains alive the cell-body is devoid of visible granularity, and is apparently homogeneous, but when the cell is dead the cell-body can be distinctly tinted by methylene blue and similar colouring matters. Examination under high magnifying powers then resolves what under lower appears to be a sheet of evenly stained substance into a cloud of minute and feebly stained particles embedded in a matrix completely unstained (2). These tiny amorphous and shrunken particles are all that are demonstrable in the way of cell contents, and are the homologues of the obvious granules in granulate cells, *e.g.*, secreting cells, many leucocytes, etc.

The large hyaline leucocyte is usually not amœboid; under many circumstances it proves itself to be nevertheless a capable phagocyte; that is to say, it can take up particles from its environment and enclose them within its cell-substance. Whether a cell in order to ingest particles must be amœboid is so far as I know undetermined, but it is conceivable that it need not be. Certainly a cell to be free and "wandering" need not be amœboid; in its "wandering" it may be the passive subject of outside forces acting upon it.

The large hyaline cell occurs in blood, in lymph, and in the tissue-spaces; it is most common in the latter. Normally it forms less than 10 per cent. of all leucocytes in the blood. When its numbers in the blood are large the blood is usually of low specific gravity, of low hæmoglobin value, and poor in chromocytes; thus it is numerous in the anæmia ensuing upon typhoid fever (4); it is also numerous in the anæmia of pregnancy. In the latter condition, though hardly in the former, there is reason to

believe the poverty of chromocytes is apparent rather than real, and that the blood is rich in plasma rather than poor in red corpuscles, *i.e.*, is polyplasmic. The plasma itself is under these circumstances not deficient in solids. In lymphatic leukœmia, where lymphocytes are in excess in the blood, the large hyaline cells are usually quite scanty.

III. *The Finely Granular Oxyphil Cell.*

Wharton Jones was the first (in 1841) to draw attention to the *granules* existing within leucocytes (5). After establishment of the view that a living animal cell consists structurally of a spongy reticulum of protoplasm containing less active material, paraplasm, in its meshes, Heidenhain and Langley early demonstrated and worked out the details of the periodic granularity of secreting cells (6). They showed that in such cells activity is commonly associated with more or less continuous storage, and with more or less intermittent discharge of material elaborated in the form of granules by the living network of the cell-body. Among the followers of these investigators have been Ehrlich (7) and, later, Altmann (8). The latter has passed from somewhat slender premises to the speculation that a discrete granule is the elementary unit of all biological structure, and that every cell is a colony of such "elementar organismen," just as the body of a metazoon is a colony of cells. These elemental bioplasts, if aggregated into cells, he terms cytoblasts; if free, the bioplasts are autoblasts; micrococci, it is urged, are autoblasts, the granules of the leucocyte, cytoblasts. But Altmann has not added much solid fact to the subject. On the other hand Ehrlich has added considerably. The latter has elaborated a scheme of microchemical tests for the granules of the various cells observed. According to Ehrlich, the staining solutions used in histology may be considered in two groups: (1) acid solutions, (2) basic solutions. In "acid" solutions the staining principle is the acid although the dye may be a chemically neutral salt; tinctorially it reacts as a free acid. Ehrlich's scheme of examination rests on determining whether a cell-granule can be stained by acid colours more

readily than by basic, or *vice versâ.* Thus, ordinary fuchsin is hydrochlorate of rosaniline; in this compound it is the base, the rosaniline, which is the staining principle, the acid, hydrochloric acid, is not the staining principle; the staining solution is therefore in Ehrlich's sense a basic one (9). Again, picrate of ammonium is an "acid" dye, because in it the picric acid is the staining principle. Ehrlich terms the cell-granules which can be more readily tinged with acid dyes, "oxyphil granules"; those which can be more readily tinged with basic dyes, "basophil".

The technique introduced by Ehrlich and his pupils in their researches of this kind is reliable and capable of wide application. In its employment it is, however, necessary to remember that it is not the living cells which are usually dealt with, and that in the course of fixation the cells and their granules become modified. It is therefore necessary to adopt some particular mode of fixation and of application of the stain as a standard, and thus to obtain standard oxyphil and basophil reactions. Kanthack and Hardy (2) proceed as follows: thin films of blood or lymph upon cover-glasses are dried in the air, and then passed quickly three times through a Bunsen flame. The films are next placed for 30″ in a solution of 5 grm. eosin in 100 c. cent. of 70 per cent. alcohol. The excess of eosin is then removed by placing the film in water, after which the film is again dried, passed thrice through the flame, and finally counterstained with Löffler's methylene blue solution (basic stain).

Examined in this way there are found among wandering cells two kinds with oxyphil granules, and two kinds with basophil granules. The cell with small oxyphil granules is that which I have placed first on our list. It may be considered κατ ἐξοχην the wandering cell of mammalian blood. The cell is of medium size, about 10 μ; its cell-substance contains small granules slightly more refracting than the ground substance in which they lie; the granules are particularly obvious in the rabbit. The nucleus is peculiar in form and fairly characteristic as distinguishing the cell from other leucocytes. It is multipartite and of extremely

irregular outline, consisting usually of lobes linked together by thread-like bonds which are composed almost entirely of chromatin. It was at one time a question whether this nucleus was a sign of degeneration and breaking down of the cell,—was in fact a "fragmentation nucleus,"—or whether it was due to some form of reproduction by budding taking place. Neither of these suppositions is now accepted; the diversity of shape of the nucleus is almost certainly attributable to distortions produced in it by the extreme amœboid activity of the cell-body (35).

The cell is a vigorously amœboid one. It is also a phagocyte. Halliburton and Brodie find that solutions of certain nucleo-albumins kill and break up these leucocytes very speedily, although without effect upon the activity of ciliated cells from epithelia (63). There is of course much fluid in the composition of these mobile cells, but the granules embedded in them never exhibit Brownian movement so long as the cell is healthy, or even so long as it is alive (10). At death of the cell its granules are at once given over to Brownian movement and to such a degree as to produce in the whole cell a shimmering appearance. This phenomenon can be easily studied in many cells of *pus*, which are often for the most part dead leucocytes. In pus cells also irregular nuclei can be studied which are really fragmented, sometimes curiously regularly into rosette forms (10); a comparison of these forms of degenerated nuclei with the irregular-shaped nuclei of the active cells is instructive as to the great real difference between the two, though both are multipartite. The granules in this cell have been described by Ehrlich and his pupils as neutrophil, under the impression that they were not stained readily by "acid" dyes. Kanthack and Hardy show that the granules are really oxyphil. They point out that in some rodents the granule is especially oxyphil, a fact that can be easily confirmed by any one who will take the trouble to stain with a standard eosin solution a dried film of rabbit's blood. The granulation in these cells becomes particularly obvious and particularly oxyphil in animals recovering from, or just recovered from,

acute bacterial infections of various kinds (11). The cell has a precise and limited distribution in the body, for under normal circumstances it occurs only in the blood, there constituting usually about 75 per cent. of all the leucocytes. It is certain that it has been detected multiplying by karyomitosis while still within the circulation and under normal conditions; it may therefore pass its whole existence within the blood-vessels; yet specimens of it showing karyomitosis are very uncommon (12). Some hold that it undergoes direct division more frequently (13). It is essentially a blood-cell, and is present in fœtal blood before the lymphocyte appears (14).

IV. *The Coarsely Granular Oxyphil Cell.*

This cell is large, usually above 12 μ diameter. Its nucleus is of less irregular shape than that of the finely granular oxyphil cell; very often its nucleus is reniform, or in the form of a horseshoe. The granules contained in the cell-body are large, shining and highly refractive. In shape they vary in different animal species; most often they are spherical, but in the cat are ovoids, and in the horse cuboids (10). They are largest and least numerous in the cells of the horse, amounting generally to not more than a dozen, whereas in many animals one cell may contain a hundred of them. They are remarkably readily and deeply stained by "acid" dyes, perhaps most readily in human blood, and least readily in rat's blood. When to fresh undried rabbit's blood a little Ehrlich-Biondi fluid is added the granules in the still living cell take up the acid fuchsin of the mixture. Treated with osmic peroxide the granules turn brown almost as deeply as do fat particles, but they are not soluble in alcohol or ether. In their high refraction and oxyphil affinity they resemble the red blood corpuscles, and like them contain both phosphorus (10) and iron (15); but they are quite colourless. Some observers from their microchemical reactions have concluded that the granules are proteid (16); if so the proteid may be nucleo-albumin; but these cells do not appear to play a part in the clotting of the blood or lymph. The granules may be considered

to be nutritive material accumulated within the cell, or to be substance elaborated by the protoplasm in virtue of secretory activity. Ranvier (17) takes the former view, Ehrlich the latter. Kanthack and Hardy (2) have shown that by bringing into the proximity of the cell certain bacteria a condition of extreme activity can be produced in it, and that under this excitation the body of the cell rapidly becomes clear of its granules. The granules are after a while reformed, but the new ones are at first not quite like those previously present. This observation of the lysis of the granules is fraught with great interest, because the same observers have shown that the cell is able to greatly damage the bacteria offered to it, and this it must effect by means of its secretion. The cell may therefore be looked upon as a free unicellular gland.

A further peculiarity of the cell is that though it is very vigorously amœboid, and can throw out remarkably active pseudopodia, it is incapable of incepting particles, and vacuoles are never seen within it. By adding to fluids containing these and other leucocytes particles suitable for recognition, *e.g.*, pigment, bacteria, crystals, etc., the large hyaline and the finely granular oxyphil cells take these up speedily, imprison them in vacuoles, and, in the case of proteid particles and bacteria, in many instances digest them; but the coarsely granular oxyphil cells, although they may affect contact with the particles, have never under any circumstances been seen to incept any. This, presumably, is the reason why in the blood of malarial patients the hyaline and finely granular leucocytes are pigmented, but the coarsely granular never exhibit pigmentation. The formation of vacuoles in the coarsely granular oxyphil leucocyte, if it occurs at all, is an event of great rarity.

The habitat of the coarsely granular oxyphil leucocyte includes the blood, the lymph, serous fluids, and the clefts of the connective tissues, except cornea and tendon. They are relatively to other leucocytes more numerous in the peritoneal fluid than in the blood or lymph; in the blood of the cat they constitute from 2 per cent. to 8 per cent. of all the leucocytes. Abstinence from food, if not very pro-

longed, seems to increase their number in the blood (9, 10); perhaps this accounts for their greater frequency in the blood of winter than of summer frogs. They are present in the blood of the fœtus from an early period of intra-uterine life. They are especially numerous in bone marrow, and it has been urged by Ehrlich that those in the blood come from the bone marrow. Kanthack has, however, shown that they can increase enormously in a limb from which all bone marrow has been removed; and it must be remembered that large islets of them occur also in the mesentery; that they can be found forming an almost unbroken sheet in the capsules of many lymphatic glands; and that they crowd the choroid plexuses of the cerebral ventricles (18). They are numerous also in the mucosa of the small intestine, and it is said especially so after chemical irritation of the membrane. Nevertheless, in view of their resemblance in many microchemical reactions to the substance composing chromocytes, it is interesting to find them especially abundant in the very tissue which is most concerned with the production of chromocytes, *i.e.*, the red marrow.

Some investigators, among them M. Heidenhain, look upon the coarsely granular oxyphil leucocyte as a cell undergoing degeneration or over-ripe. Apparently the character of the granulation of the cell-body inclines them to this view, by the same line of argument as we may sometimes legitimately follow when judging a cell to be degenerating because it contains fatty granules in it. It is noteworthy that the opinion is shared chiefly by those whose papers deal only with the morphological characters of the cell, and with it in preparations hardened and stained. It cannot, I think, be shared by any one who has studied the cell alive and active on the warm stage or in transparent tissues. To those who are acquainted with it under approximately normal conditions such a view is negatived most emphatically by the robust reactions and the high resistance to adverse conditions, *e.g.*, irrigations with weak and strong salines, etc., exhibited by the cell. Although there is every reason for rejecting the view that the oxyphil leucocyte is a degenerated or over-

ripe cell, it is not improbable that the oxyphil granule may be derived more or less directly from worn-out nuclear substance. In the testis the cells undergoing degeneration and karyolysis in the course of spermatogenesis come to contain within the shrunken cell-substance a material highly refracting and oxyphil; this substance collects in proportion as the chromatin disappears (46). Now we know that nuclei are rich in phosphorus, and that chromatin contains iron (15); and that the oxyphil granule of the leucocyte also contains both phosphorus and iron; a chemical connection between the degeneration of nuclei and the origin of oxyphil granules is, therefore, perfectly possible. It is further worth remembering that in the red marrow, with its wealth of hæmoglobin and of oxyphil granulation, there is normally a remarkable frequency of degenerate cell-forms, and the correlation of the three occurrences is well exemplified in certain pathological conditions.

In that type of leukœmia in which the spleen and bone marrow are predominantly affected and enlarged, a great number of cells which resemble the coarsely granular oxyphil cell appear in the blood. These cells are not however exactly like the normal coarsely granular leucocyte, for they are not amœboid (20), and present other minor points of difference; they resemble more closely a free cell common in marrow, which contains oxyphil substance and is not amœboid. They certainly appear to be marrow cells which have entered the blood, but it is not proven that they are identical with the coarsely granular leucocyte of blood, or that the latter is derived from the red marrow.

V. *The Finely Granular Basophil Cell.*

This is a small cell, spherical in shape, often possessing an irregularly lobed nucleus. The cell-body contains a number of minute granules which take on an intense purple tint under the action of methylene blue. The cell is a sparse but probably a normal denizen of the blood; in man it is said to be least rare in the blood in about the third hour of digestion (2), but even then it requires long searching to discover. It has not been met with in the lymph or serous

chambers, but we have at present very few facts concerning its distribution. It is certainly sometimes present in excess in the blood of uræmic patients (Grünbaum).

VI. *The Coarsely Granular Basophil Cell.*

This is one of the largest and most striking forms of leucocyte. It is in figure usually a somewhat flattened sphere; its nucleus is round and central. The granules with which the cell-body is densely laden are large, about 1 μ diameter, and are, unlike the oxyphil granules, not highly refracting. The cells themselves are more fragile than most leucocytes; they break or burst, and let loose their granules under even careful modes of preparation. They have for this reason been sometimes termed "explosive cells". They are not amœboid, nor, as far as is known, phagocytes. They form about a tenth of the collection of free cells in lymph and serous fluids. They are completely absent from the blood. They are identical, as far as their granulation is concerned, with certain fixed cells which are numerous in the connective tissue around lymph and blood-vessels—Ehrlich's *mast zellen.* Islets of such cells can be found in the mesentery accompanying certain blood-vessels. They are numerous also in the mucosa of the small intestine. To obtain striking specimens of the coarsely granular basophil leucocyte no better *locus* can be chosen than the pericardial chamber of the rat. In the moisture of that sac extremely fine examples of the cell are easily found.

It is clear from the foregoing that the morphological differences between these various leucocytes are marked enough. Some observers hold that the various forms are not distinct species of cell at all, but are merely the various aspects assumed by one and the same pleomorphic organism in successive phases of its individual life history. Such a speculation suggests itself very naturally, but is not so easy either to prove or to disprove. The "pleomorphism" view is pushed to its extreme by those pathologists who assert that leucocytes can arise by transformation of fixed connective tissue corpuscles, and that then after wandering through a

period of amœboid and vagrant existence they can settle down once more as fixed corpuscles, and produce the fibres and the variously complicated matrix of dense connective tissue, *e.g.*, in the repair of wounds. As a possibility this view is tenable, but it has been shown not to hold good in all the instances in which the sequence of events has been examined carefully (21).

That the coarsely granular basophil leucocyte and the two forms of oxyphil leucocytes must all three be considered specifically different individuals there is little reason to doubt. Whether the two forms of hyaline leucocyte are not stages of the same cell, and whether one of them or both may not be young forms of the finely granular, are possibilities that seem not improbable. Apart from the not very numerous coarsely granular oxyphil leucocytes and the much rarer finely granular basophil, the leucocytes of the blood have been classed by Ouskow (22) and Khetagorow (23) as (1) young elements, (2) ripe elements, (3) over-ripe elements. Among the young elements they place the small hyaline cells (lymphocytes) and some hyaline forms not much larger than lymphocytes. By ripe elements they mean the large hyaline forms and certain others transitional in appearance between those and the finely granular oxyphil; these last are their over-ripe elements. They believe the lymphocytes enter the blood from the lymph glands and from the spleen, and the somewhat larger hyaline form from the red marrow. These views are at present, however, conjectural rather than based on any actual demonstration.

As to the life history of the coarsely granular oxyphil cell there is a small element met with in serous fluid and blood which is probably the young form of this cell. It has a spherical nucleus and a scanty amount of cell-substance containing a few granules of the typical appearance and reaction. Similarly it is fairly easy to trace the individual growth of the coarsely granular basophil cell from a small cell somewhat like a lymphocyte, except that its scanty cell-substance contains the characteristic basophil granulation; every intermediate form up to the large "mast

zelle" can by a little searching be discovered. The existence of these various forms of young cell argues strongly against pleomorphism explaining the existence of the different adult forms.

Two facts rise saliently out of the investigation of the granulation contained in leucocytes. In the first place one and the same individual cell never contains at one and the same time two different kinds of granules: all the granules within it are of similar quality, as least as far as they can be tested by the microscopical reactions at present available. If the cell at one time produced one kind of granule, and at another time another, this is hardly what would have been expected. In the second place the granular material present in them is of extremely wide distribution in the animal kingdom. For instance, the eosinophil granule can be studied alike in the Vermes (24), Mollusca (25) and Arthropods, as well as throughout all classes of the Vertebrata. It would seem of very ancient origin in the evolution of animal structure, and it must possess physiological significance of some fundamental kind. What that significance may be we have at present very little opportunity of gauging; it has been suggested above that it may have to do with the formation of hæmoglobin, but the eosinophil substance is present in some animals that are not possessed of any hæmoglobin. It has been mentioned above that this granule has some bactericidal power (2), but inasmuch as that power can only be exercised under abnormal conditions it is not to be considered an attribute which explains the normal production of the material.

An inquiry may be raised as to how far it is permissible to consider cells to be necessarily of the same kind or closely genetically connected simply because they contain granules of the same material. If, for instance, the occurrence of fat in cells be used for argument, in the same way it may be urged that certain liver cells and certain connective tissue corpuscles are closely allied structures. Certainly some connective tissue corpuscles contain coarse oxyphil granules of appearance and quality similar to those in the

wandering cells; it does not however appear to me on that account permissible for us to consider that the cells themselves are to be classed as similar.

Study of the varieties of leucocytes brings out clearly the fact that in the wandering cells taken as a group digestive activity is prominent, and that the secretion of digestive juices is a function highly developed in them. In some varieties the secretion is poured out into a special "vacuole" in which the food or prey is by the motive power of the cell surrounded; the digestion takes place then in what may be called an "intracellular" manner. The phenomenon termed "phagocytosis" is a particular instance of this "intracellular" digestion. Metschnikoff, whose attention has been largely devoted to this subject, considers that in "phagocytosis" we have the primary and central fact not only of many normal processes, but also of the great pathological process of inflammation; he even defines inflammation as a "phagocytic reaction," and attempts to explain all resistance to and immunity from infectious disease by means of this particular phenomenon, limited though it is to certain varieties of cell. This narrow view leaves out of consideration reactions which are, at least as constantly as "phagocytosis," a part of the inflammation process, and of immunity and resistance. Furthermore, strangely enough it overlooks altogether the more general and more potent extracellular method of digestion in which the cells attack food and prey in their immediate environment, dissolving these without incepting any particles of them. This is the process which reaches its extreme perfection in the secretory epithelia of the various special digestive glands, such as the salivary and intestinal; but it is recognisable in unicellular organisms, and, as above mentioned, in the coarsely granular oxyphil leucocyte.

I should extend the length of the present article too greatly were I to attempt here any account of the various forms and grades of "leucocytosis," that is to say, of numerical increase of the wandering cells collected in a part. Could we include such a description within this

scope, more interesting, and even more obvious than the above outline indicates, would appear the differences between the various kinds of leucocytes alike in regard to function and to structure.

BIBLIOGRAPHY.

The chief and more recent only are given. For an excellent bibliography of the subject up to 1890 see Gulland. *Labor. Reports Roy. Coll. of Physicians, Edinburgh*, vol. iii., 1891.

(1) *Virchow's Cellular Pathologie*, 4th edition.

(2) KANTHACK and HARDY. *Proc. Roy. Soc.*, vol. lii., 1892; *Philos. Transact. Roy. Soc.*, 1894; *Journ. of Physiology*, vol. xvii., 1894; and separate papers.

(3) FLEMING. *Archiv f. Mikro. Anat.*, vol. xxiv., 1885.

(4) THAYER. *Johns Hopkins' Hospital Report*, vol. iv., 1894.

(5) WHARTON JONES. *Phil. Trans. Roy. Soc.*, 1841.

(6) HEIDENHAIN. Papers since 1868 (*Beit. z. Lehre v. d. Speich. Stud. des Physiol. Instit. zu Breslau*, etc.). LANGLEY. Papers since 1878 (*Journ. of Physiol.*, vol. ii., etc.).

(7) EHRLICH. Papers since 1879 (*Ueb. die specifischen Granulation des Blutes, Du Bois' Archiv*, etc.).

(8) ALTMANN. *Ueber die Elementarorganismen*, 1885.

(9) KANTHACK. *Med. Chronicle*, Aug., Sept., Oct., 1894.

(10) SHERRINGTON. *Proc. Roy. Soc.*, vol. lv., Dec., 1893.

(11) EVERARD, DEMOOR and MASSART. *Trans. de l'Institut Solvay, Université de Bruxelles*, 1893.

(12) M. HEIDENHAIN. *Kern und Protoplasma*. Leipzig, 1892.

(13) LÖWIT. *Sitzungs. d. k. Akad. Wien*, vol. xcii., part iii., 1885; also *Centralb. f. Patholog.*, 1894.

(14) GULLAND. *Journ. of Pathol.*, vol. ii., 1894.

(15) MACALLUM. *Proc. Roy. Soc.*, 1892.
L. E. BARKER. *Johns Hopkins' Hospital Bulletin*, Oct., 1894.

(16) RENAUT. *Arch. d. Physiol. Normale et Pathol.*, vol. xiii., 1881.

(17) RANVIER. *Traité technique d'histologie.*

(18) PRENANT. *Journ. Internat. d'Anat. et de Physiol.*, vol. xi., 1894.

(19) R. HEIDENHAIN. *Pflüger's Archiv*, vol. xliii., Supplement, 1888.

(20) RIEDER. *Beit. z. Kenntniss d. Leucocytose.* Leipzig, 1892.
MUIR. *Journ. of Pathol.*, vol. i., 1892.

(21) SHERRINGTON and BALLANCE. *Journ. of Physiol.*, 1889.
NIKIFOROFF. *Ziegler's Beiträge*, 1890.

(22) OUSKOW. *The Blood as a Tissue* (Russian). St. Petersburg, 1890.

(23) KHETAGOROW. *Virchow's Archiv*, vol. cxx., 1891.

(24) LIM BOOM KENG. *Proc. Roy. Soc.*, 1893.

(25) KNOLL. *Sitzungsb. d. k. Akad. Wien.*, 1893.

(26) REINERT. *Die Zählung der Blutkösperchen.* Leipzig, 1891.

(27) HÖLSCHER. *Müncheuer Med. Woch.*, 38, 1891.
(28) THAYER. *Boston Med. and Surg. Journ.*, 1893.
(29) WINTERNITZ. *Centralbl. f. Klin. Med.*, March, 1893.
(30) THAYER. *Johns Hopkins' Hosp. Bull.*, 1893.
(31) EMELIANOW. *Arch. d. Sciences Biol.* St. Petersburg, 1893.
(32) LÖWIT. *Stud. z. Physiol. u. Pathol. d. Blutes.* Jena, 1892.
(33) V. LIMBECK. *Arch. f. Heilkunde*, vol. x., 1890.
(34) PICK. *Prager Med. Wochen.*, 24, 1890.
(35) ARNOLD.. *Arch. f. Mikr. Anat.*, vol. xxx., 1887.
KORSCHELT. *Zool. Jahrb.*, vol. iv., 1889.
DEKHUYSEN. *Verh. d. Anat. Gesellsch.*, 1890.
GULLAND. *Lab. Rep. Roy. Coll. Phys., Edinburgh*, 1891.
SHERRINGTON. *Proc. of the Intern. Congress of Physiol.* Liège, 1892.
(36) HOWELL. *Journ. of Morph.*, vol. iv., 1890.
(37) SCHMIDT. *Pflüger's Archiv*, vol. ix., p. 353.
(38) STRICKER. *Photogramm e. farblosen Blütkörpchen.* Wien, 1890.
(39) LAVDOUSKI. *Virchow's Archiv*, vol. xcvi.
(40) MÜLLER. *Sitzung. d. k. Akad., Wien*, iii., vol. xcviii., 1889.
(41) CANON. *Deutsch. Med. Woch.*, 1892.
(42) FELSEN. *Arch. f. Kinderheilkunde*, vol. xv., 1892.
(43) NOORDEN. *Zeitsch. f. Klin. Med.*, vol. xx., 1892.
(44) HANKIN. *Centralb. f. Bacteriol.*, vol. xii., 1892.
(45) ZAPPERT. *Zeitsch. f. Klin. Med.*, vol. xxiii., 1894.
(46) TETTENHAMER. *Anat. Anzeiger.*, 1893.
(47) VAN DER STRICHT. *Arch. de Biol.*, vol. xii., 1892. Also *Verhandl. d. Anat. Gesellsch.* Göttingen, 1893.
(48) SPILLING. *Uber Blutuntersuchungen bei Leukämie.* Berlin, 1890.
(49) ALDEHOFF. *Prag. Med. Woch.*, 8, 1891.
(50) BERGONZINI. *Anat. Anzeiger.*, 1891.
(51) CUÉNOT. *Archiv de Biol.*, vol. xiii., 1893.
(52) GRIESBACH. *Pflüger's Archiv*, vol. l., 1891.
(53) MÜLLER and RIEDER. *Archiv f. Klin. Med.*, vol. xlvii., 1891.
(54) PELIZZI. *Revista Speriment. di freniatria*, fasc. 1, 1893.
(55) PRENANT. *La Cellule*, vol. x., 1894.
(56) SCARPATETTI. *Archiv f. Mikr. Anat.*, vol. xxxviii., 1891.
(57) SCHAFFER. *Centralb. f. di Med. Wissensch.*, 1891.
(58) OKINTSCHITZ. *Archiv f. exp. Path. u. Pharm.*, vol. xxxi.
(59) KIKODSE. *Centralb. f. allg. Path.*, vol. ii., p. 109.
(60) TSCHISTOWITSCH. *Berlin Klin. Woch.*, No. 34, 1891.
(61) CHATENAY. *Les réactions leucocytaires.* Paris, 1894.
(62) MUIR. *Journ. of Anat. and Physiol.*, vol. xxv., 1891.
(63) HALLIBURTON and BRODIE. *Journ. of Physiol.*, vol. xvii., p. 135, Aug., 1894.

C. S. SHERRINGTON.

COAL: ITS STRUCTURE AND FORMATION.

PART II.

STRICTLY speaking, the subject of microscopical structures in coal should include some account of the sphærosiderite nodules which occasionally occur in seams of coal. It is from these nodules that Binney, Carruthers, Williamson and others have obtained material for the anatomical investigation of Coal-Measure plants; the majority of the invaluable treasures contained in Professor Williamson's unique collection of Carboniferous plants have been prepared from such nodules. According to Stur we should regard these small nodular masses as patches of partially decomposed plant substance, mineralised by carbonated waters, and thus preserved as sample specimens of a peat-like accumulation which was, for the most part, gradually converted into coal.[1] In the Reichsanstalt museum, in Vienna, there is an exceedingly interesting specimen of a block of coal containing elliptical or spherical nodules of sphærosiderite, with some pieces of crystalline igneous rocks embedded in a matrix of coal. Stur considers that these mineralised patches of peat lend considerable support to the growth-in-place theory of coal formation; but, as Grand' Eury has pointed out, it is not difficult to understand the mineralisation of nests of plant tissue by the action of petrifying solutions in a mass of subaqueous vegetable *débris*. The occurrence of boulders of different kinds of rock in coal beds is a subject of great interest, but it is impossible to give any adequate summary of the recorded facts in the present incomplete sketch.[2] Some geologists, with their firm belief in the autochthonous formation of coal, suggested a meteoric origin for such stones; others adopted a more rational view, and regarded them as erratic blocks which had been carried by floating trees or ice, and finally dropped into a peaty deposit on the floor of a lagoon. The occurrence of the so-called coal balls is

[1] See also Binney, p. 14. [2] For references, see Geikie and Stur.

of considerable interest; these are rounded pieces of coal occasionally met with in seams of coal of a somewhat different physical nature to the included balls. Logan long ago mentioned their occurrence in South Wales, and Renault, Fremy and others have since described them at some length, and discussed their probable manner of formation in the case of the French Coal-Measures. These balls are frequently more porous than the coal in which they occur; they are looked upon as water-worn fragments of older carbonaceous strata. Renault and others make use of the coal balls as an argument in favour of the rapid carbonisation of vegetable deposits; they believe that certain beds of plant material in the Commentry basin were converted into a more or less porous form of coal, and suffered disintegration prior to the complete deposition of other seams in the same area.

Whilst some geologists have preferred to regard coal as an advanced stage in the gradual compression and chemical alteration of peat mosses, others have held fast to the idea that each seam of coal marks the site of a thick mass of vegetable accumulation, derived from a dense and long-continued forest growth on a gradually subsiding area. "The same area was alternately covered with vast forests, such as we see in the deltas of great rivers in warm climates, which are liable to be submerged beneath fresh or salt water should the land sink vertically a few feet."[1]

Geikie, in the recent edition of his text-book, briefly describes this autochthonous method of coal formation, but goes on to devote a few lines to Fayol's work in the Commentry coalfield of France, and admits the strong case which this experienced geologist has founded on his detailed researches. Geikie concludes by expressing the opinion that "it would thus appear that no one hypothesis is universally applicable for the explanation of the origin of coal, but that growth on the spot and transport from neighbouring land have both, in different regions, contemporaneously and at

[1] Lyell (1), p. 388. (Good figures of "spore coal" sections are given on p. 405.)

successive periods come into play". In his excellent *Traité de Geologie* De Lapparent[1] enters more fully into the question of coal formation, and states, at some length, the arguments advanced by recent workers in favour of the drift theory or allochthonous origin of coal seams. The tendency in England seems to have been much too conservative with reference to this matter, and it is only by slow degrees that any adequate recognition has been accorded to the strong case against the old orthodox opinions as to the formation of coal. In Solms-Laubach's encyclopædic text-book on fossil botany we have an extremely interesting account of the present state of our knowledge as to the nature of coal and its manner of production. A sketch is given of Grand' Eury's views, and the geographical and physical conditions are depicted, which seem to have obtained according to the comparatively recent theory of this French savant. In 1882 a full account of Grand' Eury's views appeared in the *Revue de deux Mondes*, written by the ready pen of the Marquis of Saporta. Before noticing some of the more important points in Grand' Eury's arguments, reference must be made to a much earlier work by an English geologist. The importance of Beete Jukes' studies in the South Staffordshire coalfield does not appear to have been adequately recognised by English geologists, but in the works of their French *confrères* we find frequent references to this valuable survey memoir. One of the most striking features exhibited by the Staffordshire coal beds is the splitting of a thirty-foot seam, when traced in a northerly direction, into ten to fourteen distinct seams, separated by intervening beds of sandstones and shales. A section of the strata in one area shows a mass of coal thirty feet in thickness, in another section, not more than five miles in a horizontal direction from the first, the thirty-foot seam has become sub-divided into several beds, which are interstratified in a series of sedimentary rocks three hundred feet thick. This splitting of beds towards a particular direction is "a kind of change quite familiar to those who are accustomed to trace any set

[1] P. 860.

of beds continuously along the strike,"[1] and the explanation of the same kind of phenomenon in a series of ordinary sediments would involve no exceptional conditions of sedimentation. A river flowing into an open lake or sea would deposit a mass of sand and mud near its mouth, but in the deeper and clearer waters the deposits would be made up almost entirely of fine sediment, which would be spread out over a much larger area; thus building up in the whole area of sedimentation a series of beds, of which the heavier and coarser materials would gradually preponderate in a direction towards the source of supply. Regarded, therefore, as an ordinary series of sedimentary deposits, the Staffordshire sections are not difficult to interpret, but if we must adhere to the theory of an intermittent subsidence taking place over one part of a small area, and not over another, the reading of the sections becomes a matter of much greater difficulty.

This splitting of coal seams, which occurs on an unusually large scale in the Staffordshire coalfield, is of frequent occurrence in other districts.[2]

The theory of a gradually sinking area, with periods of subsidence alternating with intervals of rest and luxuriant forest growth, was formulated by Bowman in 1840, and has been accepted by Lyell and the majority of geologists as a satisfactory method of explaining the blending and splitting of coal seams. The more reasonable point of view is surely that adopted by Beete Jukes, Grand' Eury, and other writers, which regards the seams of coal as beds of vegetable sediment, deposited under the same conditions as strata of arenaceous and argillaceous materials. The regularity and uniform character of coal beds is occasionally interrupted by the occurrence of sandstone patches and other foreign material, constituting the "rock and rig" or "rolls and swells" of English miners. Such patches of sandstone offer no great difficulty to the geologist who looks to the ordinary rules of sedimentation for an explanation of the facts; the "rolls and swells" are simply ridge-like accumulations of sand or mud piled up on the floor of the area of deposition.

[1] Jukes, p. 19. [2] See Grand' Eury (2), Pls. xxii. and xxiv., etc.

Grand' Eury[1] describes several instances of the same kind, and, like Beete Jukes, draws attention to the fact that the coal was laid down in horizontal beds, none being deposited on the crests of the sandstone ridges until the whole floor had been raised to that level. This method of deposition points to the existence of currents rather than a quiet sheet of water in which the sediment would slowly sink to the bottom, and fill up all irregularities of surface contour. The existence of the numerous thin laminæ in coal is another fact which influenced Jukes in his choice of the drift theory of coal formation. Attention has recently been directed to this laminar structure by another advocate of the allochthonous origin of coal seams.[2]

Grand' Eury's exhaustive memoirs on the foundation of coal supply us with a considerable amount of evidence collected by one intimately acquainted with the geology and botany of the upper carboniferous rocks; and the facts which he brings forward clearly point to the subaqueous deposition of layers of carbonaceous sediment. He does not favour the view that the vegetable *débris* was drifted for a long distance from forest-covered land, but considers the facts more readily explained on the assumption of a comparatively short transport. Grand' Eury's views are thus concisely stated by Solms-Laubach:[3] "Coal seams were formed in broad land-locked lake basins (lagoons) surrounded by wooded swamps, in which the decaying vegetation, softening and rotting as it lay on the ground, produced in time a layer of matter of vast thickness. The water of frequent rain-storms running slowly off in trickling streams gradually carried away with it the softened wood in shreds from inside the encasing rind, which was itself ultimately broken up and conveyed with other deposits into the basin. Here the processes which lead to the formation of coal took the place of decay, the mass of the coal being produced from the rind, while the particles of softened wood were converted into fibrous coal. The masses of aquatic and marsh plants, which covered the surface and margins of the basin with

[1] Grand' Eury (2). [2] Gresley. See also Goodchild. [3] P. 23 (1).

their luxuriant growth, also supplied their contingent in the form of the parts which died and sank to the bottom."

Without attempting to give any full account of the facts on which this particular theory has been founded, a brief summary of the main arguments, advanced by the supporters of the allochthonous origin of coal, may serve to draw attention to some of the more recent views which, on the whole, seem more adequate to explain the method of coal formation than those usually accepted. If the plant fragments, from which coal has been formed, had gradually accumulated on the floor of coal period forests, we should expect to find in them more commonly a close association of fragments of the same species or genus of plant, but, as a rule, we have a heterogeneous assemblage of all kinds of plants, much more suggestive of drifted vegetable *débris* than a collection *in situ* of forest vegetation.

In a mass of plant *débris*, covering the site of a former forest, we should look for the occurrence of large stems, and more complete specimens of leaves or branches, instead of a fine vegetable paste containing a few scattered fragments of plant tissues.

The nature and manner of occurrence of the underclay stigmarias are matters of great importance from our present point of view. The serious difficulty to be explained by the supporters of the growth-in-place theory is the absence in nearly every case of the stems of *Sigillaria* or *Lepidodendron*, in direct connection with the dichotomously branched stigmarias. One or two instances have been recorded of sigillarian stems passing up into the coal from a stigmarian root in the underlying rock, but there is a striking absence of satisfactory instances of such a mode of occurrence of these plants.

Grand' Eury regards many of the stigmarian fossils as aquatic rhizomes, and in several instances he admits there can be little doubt but that they occur in place. Potonié[1] has recently called attention to the manner of occurrence of *Stigmaria*, with its delicate appendages radiating in all directions

[1] Potonié (1).

through the unstratified underclay, as a strong argument in support of the autochthonous views; but he apparently overlooks the fact that it is generally admitted that these plants are often found in their position of growth, a mode of occurrence which does not at all preclude the deposition of coaly sediment on a submerged floor, penetrated by roots or creeping rhizomes. An old land surface may easily become covered with water, or form the floor of a lake in which vegetable sediment is being accumulated, or, as some hold, the stigmarian soils may very likely have been under water during the growth of the plants. It must not be forgotten that in some districts stigmarian underclays are not found below seams of coal, and even in England their occurrence is by no means universal. On the other hand it not unfrequently happens that the underclays are overlain by grits or sandstones, and not by a bed of coal. The frequent irregularity in the floor surface of a coal seam, and the distinct unconformity between the coal and the underlying rock, clearly points to an interval between the deposition of the floor rock and the formation of the coal. Denudation must have taken place in this interval between the deposition of the two sets of beds, and the stem portions of the trees removed before the carbonaceous sediments were laid down on the submerged underclays. Grand' Eury includes in the family of *Stigmareæ* two forms of plants: the true stigmarias he regards as rhizomes, which floated in water or grew on the surface mud, into which their branches penetrated; the true roots of *Sigillaria* he speaks of under the name *Stigmariopsis*, and sees in them certain well-marked structural peculiarities. Some further light has lately been thrown on this vexed question by the results set forward in an interesting memoir by Solms-Laubach;[1] but a detailed consideration of the stigmarian question must be deferred to a later article.

The occurrence over large areas of uniformly pure beds of coal is frequently urged against the theory of drifted vegetable *débris*. This fairly constant character in a wide-

[1] Solms-Laubach (2).

spread deposit is by no means confined to coal seams; among the Palæozoic strata sheets of fine-grained muds may be followed over considerable tracts of country without any great change in lithological structure. If we take into account the lightness of vegetable fragments, and of the ulmic substances which would be carried away by water flowing over the partially decayed accumulations on forest-clad surfaces, it is not difficult to understand how such sediments might have been spread out over an area of wide extent, with little or no admixture of heavier detrital material. Fayol's instructive experiments[1] on the conditions of sedimentation fully bear out the assertion that in many coal basins the manner of occurrence of coals, sandstones, and shales, is exactly analogous to that of a series of subaqueous deposits laid down in a quiet fresh-water lagoon, or on the floor of a current-swept area of deposition. The same observer has made out a very good case with regard to the vertical stems well known to those familiar with Coal-Measure stratigraphy; many of these have undoubtedly been drifted, and have finally settled down in the sand or mud in an erect position. Instances of calamitean and other trunks preserved where they grew in a swampy or submerged region are by no means unknown. Grand' Eury and other French writers have figured several examples of such stems, showing a series of adventitious roots developed at successively higher levels on the axis, and radiating out into the surrounding and growing sediment.

The enormous amount of time necessitated by the growth-in-place theory would seem to be a matter of some difficulty. Geologists have been warned by physicists, whether on good grounds or not cannot here be discussed, that it is no longer possible to draw unlimited "time cheques" in support of any theory which involves long periods of time. The sedimentation method of formation does not make any such exorbitant demands on the duration of the coal-producing era. Many authorities have laid stress on the gradual passage of pure coal through impure

[1] P. 365, *et seq.*

varieties and carbonaceous shale to ordinary shale or grit; and, indeed, the stratigraphical evidence unmistakably suggests that we must look upon beds of coal as units in a series of strata built up on an area of deposition according to a common law of sedimentation. The chemistry of coal formation is too wide a theme to deal with in an article which has already extended beyond reasonable limits. The processes of change seem to have gone on much more rapidly than is usually supposed, if we endorse the conclusions of Renault and others. Some writers consider the coaly transformation of plant tissues must have required not only pressure, but a considerable amount of heat. Others, again, believe that a mass of decaying vegetable matter has undergone a kind of peaty fermentation, resulting in the partial carbonisation of the tissues, and the production of various ulmic substances. This vegetable sediment would be spread out on the floor of a lagoon, and eventually covered with mud or sand, when the further stages in the process of carbonisation would be completed by a gradual desiccation of the whole mass under some pressure and a comparatively low temperature.

Much has been written as to the reduction in bulk of vegetable tissues as a result of their conversion into coal. The late Dr. Stur attempted to estimate the amount of decrease in volume, and suggested a simple formula by which to calculate the original diameter of a plant's stem or root, from the thickness of the coaly layer which frequently envelops a pith cast in sandstone or shale. Calculations have been made by other palæobotanists, which differ considerably from those of Stur, but as Potonié[1] safely suggests, we cannot expect to arrive at any numerical estimate of the volume reduction which may be applied to all cases.

Neglecting for the present the probable climatic conditions which characterised the coal period forests, and the discussion of the biology of coal-forming plants, we may, in conclusion, make brief reference to a few of the numerous descriptions of recent geographical conditions which have

[1] Potonié (2).

been quoted as possible parallels to those of the coal age. M. Rigaud looks to the pitch lake of Trinidad and similar places as the nearest representatives to-day of Coal-Measure conditions; Lyell and others have referred to the great Dismal Swamp of Virginia as the most accurate picture of coal forests and the accumulation of plant *débris*. An interesting account of this famous North American region has lately been published in one of the annual reports of the United States Geological Survey.[1] The upholders of the drift theory, as propounded by Fayol, point to the delta deposits of the Mississippi and other rivers, which transport enormous masses of vegetable material; and a more recent writer, Ochsenius, calls special attention to the Pemisco lake, and other similar sheets of water in close connection with the Mississippi channel, as very likely places for coal building. Lyell's description of the Mississippi[2] and its drifted rafts of timber enables us to realise at least one possible manner of vegetable accumulation in a delta deposit, or in lagoons bordering the main stream. The well-wooded swamps on either side of the river banks serve to filter off the coarser materials from the overflowing waters in the flood seasons, thus allowing the finer muddy sediment to be carried for a greater distance, and spread out as "a stiff unctuous black soil which gradually envelops the basis of trees growing on the borders of the swamp". Grand' Eury's view of a short-distance transport necessitates a state of things very difficult to parallel at the present day. Stur, Lesquereux, and others, regard the coal beds as Palæozoic peat formations, and, arguing from this analogy, Neumayr maintains the probability of a temperate rather than a tropical climate during the Permo-Carboniferous epoch. It is easy to recognise in many river deltas conditions similar to those which doubtless obtained during the deposition of beds of cannel coal and other carbonaceous sediments, which bear clear indications of subaqueous formation. Some of the widespread sheets of fairly pure coal may probably be best explained by some such concurrence of conditions as Grand' Eury has

[1] Shaler. [2] Lyell (2), vol. i., chap. xix.

suggested, or in other cases we may find a satisfactory analogy in the extensive sheets of vegetable mud spread out on the floor of a lagoon or lake after transport by the raft-covered waters of a river.

The peat bog method of formation, or the accumulation and subsequent sealing up of vast thickness of forest *débris*, present serious difficulties to be overcome, and require certain conditions which we are not warranted in assuming for upper carboniferous times. A certain proportion of the material, which has played a part in coal formation, was, in all probability, derived from floating vegetation, and from the *débris* of plants growing on submerged ground. The description by African travellers of the dense masses of floating weeds and soft pulpy vegetable material which prove an efficient barrier to navigation, affords a picture of one possible source of vegetable sediment which might, under certain conditions, be converted into coal.

Mr. Graham Kerr has been good enough to draw up the following brief account of the floating vegetation in some South American waters; such conditions as he describes may well have occurred during the coal-producing age. "A very large area of the more central parts of the 'Gran Chaco' is covered by wide-spreading swamps and extensive lagunas. The latter are normally of great extent, and are in many cases completely covered with a floating carpet consisting mostly of *Azolla* and *Pistia*, often accompanied by *Pontederia.* As the periodic dry seasons come round, the lagunas shrink in volume, and the floating carpet is gradually let down until it finally rests on the ground. The *Azolla* develops its sporangia in great numbers, but the plants themselves mostly rot away, and in the black deposit of the laguna floor one finds their remains, including the numerous sporangia. The rivers of the Paraguay-Paraná system are subject to periodic 'crecientes,' in which the level of their waters often rises some thirty feet. During these periods of high water one meets with enormous floating islands made up of tree trunks, masses of *Pontederia* and other plants, the latter of which have been floated out of the lagunas of the Chaco, etc. These floating islands carry down with

them numerous tropical plants and animals. Cases have been recorded in which even jaguars and other large mammals have been carried down to the lower reaches of the Paraná and the region of its delta."

Other conditions, which recall Fayol's description of the Commentry Permo-Carboniferous lake basins and the water-borne vegetable sediment, have been described to me by Mr. Philip Lake, late of the Indian Geological Survey. On the floor of the Travancore back waters of Southern India, a very carbonaceous deposit is being formed from the material carried to the sea by rivers which have flowed through a forest-covered country; these extensive beds of fairly pure vegetable sediment, in process of accumulation, may well be compared with the first stages in the building up of coal seams. Dr. Gregory, in a paper on the Norfolk Broads, would have us look nearer home for a modern illustration of coal-forming conditions. He suggests that a study of the Broads "enables us to follow in detail the history of a great estuary, and it presents us with, perhaps, the closest analogy to the conditions of the formation of our coalfields".

We may sum up the whole matter by expressing the conviction that the weight of evidence seems to tip the balance of opinion very materially towards the theory of drifting, and subaqueous sedimentation, for the majority of the Palæozoic coal seams. Some coals are probably old peat bogs or similar autochthonous formations, which have passed into the state of coal as the result of favourable physical conditions. But while suggesting the allochthonous manner of formation as the most widely applicable, we may conclude with the saving clause that "die Natur nicht alles über einen Leist geschlagen hat".[1]

BIBLIOGRAPHY.

BALFOUR, J. H. On certain vegetable organisms found in coal from Fordel. *Trans. R. Soc., Edin.*, vol. xxi., 1857, p. 187.

[1] Gümbel, p. 206.

BENNETT, J. H. An investigation into the structure of the Torbane Hill mineral, and of various kinds of coal. *Trans. R. Soc., Edin.*, vol. xxi., 1857, p. 175.

BERTRAND, C. E. Conférences sur les Charbons de terre; Première Conférence faite à la soc. Belg. géol. pal. et d' Hydrol. Pt. i., Les Bogheads à algæs. *Bull. Soc. Belg. Geol.*, etc., vol. vii., 1893, p. 45.

BINNEY, E. W. Observations on the structure of fossil plants found in the coal strata. Pt. i. *Palæontographical Soc., London*, 1868.

BOWMAN, J. E. On the origin of coal, and the geological conditions under which it was produced. *Trans. Manchester Geol. Soc.*, vol. i., 1841, p. 90.

"COAL," its history and uses. Edited by Prof. Thorpe, London, 1878.

DAWSON, J. W. (1) On vegetable structures in coal. *Quart. Jour. Geol. Soc.*, vol. xv., 1859, p. 626.

DAWSON, J. W. (2) On spore cases in coals. *Amer. Jour. Sci.*, vol. i. [3], 1871, p. 256.

FAYOL, H. Études sur le terrain houiller de Commentry. Lithologie et stratigraphie. *Bull Soc. Indust. Min.*, vol. xv. [2], 1886. St. Etienne, 1887.

FISCHER, H., and RÜST, D. Ueber das mikroskopische und optische Verhalten verschiedener Kohlenwasserstoffe, Harze und Kohlen. *Zeitsch. Kryst. Min.*, vol. vii., 1883, p. 209.

FRÉMY, E. Recherches chimiques sur le formation de la houille. *Compt. Rend.*, vol. lxxxviii., 1879, p. 1048.

GEIKIE, A. Text-book of Geology. London, 1893 (edit. iii.).

GOEPPERT, H. R. Antwort auf die Preisfrage—"Man suche durch genaue Untersuchungen darzuthun, ob die Steinkohlenlagen aus Pflanzen entstanden sind, welche an den Stellen, wo jene gefunden werden, wuchsen; oder ob diese Pflanzen an anderen Orten lebten, und noch den Stellen, wo sind die Steinkohlenlagen befinden, hingeführt wurden?" *Naturkund. Vertand, Holland. Maatschap. Wetensch. Haarlem*, 1848.

GOODCHILD, J. G. On some modes of formation of coal seams. *Geol. Mag.*, vol. vii. [3], 1889, p. 308.

GRAND' EURY, C. (1) Mémoire sur la formation de la houille. *Ann. Mines*, vol. i. [8], 1882, p. 99.

GRAND' EURY, C. (2) Formation des couches de houille et du terrain houiller. *Mém. Geol. Soc., France*, vol. iv. [3], 1887.

GRAND' EURY. C. (3) Géologie et paléontologie du bassin houiller du Gard. St. Etienne, 1890.

GREGORY, J. W. The Norfolk Broads. *Nat. Sci.*, vol. i., 1892, p. 35.

GRESLEY, W. S. Note on further discoveries of *Stigmaria* (*? ficoides*), and their bearing upon the question of the formation of coal beds. *Mid. Naturalist*, vol. xii., 1889, p. 25.

GRESLEY, W. S. Questions relating to the formation of coal seams, including a new theory of them, etc. *Proc. Geol. Soc.*, No. 628, 1894, p. 116.

GÜMBEL, VON, C. W. Beiträge zur Kenntniss der Texturverhältnisse der Mineralkohlen. Sitzbericht. K. bayer Akad. Wiss. München. Math. Physik. Cl., heft i., 1883, p. 111.

HULL, E. The coalfields of Great Britain. London, 1882 (edit. iv.).

HUTTON, W. Observations on coal. *Proc. Geol. Soc.*, vol. i., 1833, p. 415.

HUXLEY, T. H. On the formation of coal. Critiques and addresses, p. 92. London, 1873.

JUKES, J. BEETE. The South Staffordshire Coalfield. *Mem. Geol. Surv.*, 1859 (edit. ii.).

KIDSTON, R., and BENNIE, J. On the occurrence of spores in the Carboniferous formation of Scotland. *Proc. R. Phys. Soc., Edinburgh*, vol. ix., 1886, p. 82.

LAPPARENT, A. DE. Traité de géologie. Paris, 1885.

LESQUEREUX, L. General remarks on the distribution of the coal plants in Pennsylvania, and on the formation of coal. *Geol. Penn.*, H. D. Rogers, vol. ii., pt. ii., 1858, p. 837.

LINK. Die Urwelt und das Alterthum erläutert durch die Naturkunde. Berlin, 1821.

LINK, H. Ueber den Ursprung der Steinkohlen und Braunkohlen nach mikroskopischen Untersuchungen. Akad. Wiss., Berlin, 1838, p. 33.

LOGAN, W. E. On the characters of the beds of clay immediately below the coal seams of South Wales, and on the occurrence of boulders of coal in the Pennant grit of that district. *Trans. Geol. Soc.*, vol. vi. [2], 1842, p. 491.

LYELL, C. (1) The student's elements of geology. London, 1878 (edit. iii.).

LYELL, C. (2) Principles of Geology. London, 1867 (edit. x.).

NEUMAYR, M. The climate of past ages. *Nature*, 1890, pp. 148, 175.

NEWTON, E. T. On "Tasmanite" and Australian white coal. *Geol. Mag.*, vol. ii. [2], 1875, p. 1.

OCHSENIUS, C. Die Bildung von Kohlenflötzen. *Zeitsch. deutsch. geol. Ges.*, vol. xliv., 1892, p. 84.

PARKINSON, J. Organic remains of a former world. London, 1811.

PHILLIPS, J. On the microscopic structure of coal. *Brit. Assoc. Report*, ii., 1842, p. 47.

PHILLIPS, W. The breaking of the Shropshire meres. *Mid. Nat.*, vol. xvi., 1893, p. 56.

POTONIÉ, H. (1) Eine gewöhnliche Art der Erhaltung von *Stigmaria*, als Beweis für die Autochthonie von Carbon Pflanzen. *Zeitsch. Deutsch. geol. Ges.*, vol. xlv., 1893, p. 97.

POTONIÉ, H. (2) Ueber die Volumen Reduktion bei Umwandlung von Pflanzen—material in Steinkohle, *Glückauf*, 1893, No. 80.

QUEKETT, J. On the minute structure of a peculiar combustible mineral, from the Coal-Measures of Torbane Hill, near Bathgate, Linlithgowshire, known in commerce as Boghead Cannel Coal. *Quart. Jour. Mic. Soc.*, vol. ii., 1854, p. 34.

REINSCH, P. F. Entdechung neuer pflanzlichen Gebilde in der Steinkohle und im Anthrazit, 1880.

REINSCH, P. F. Neue Untersuchungen über die mikrostruktur der Steinkohle des Carbons, der Dyas und Trias. Leipzig, 1881.

RENAULT, B. Quatrième note pour servir à l' histoire de la formation de la houille ; galets de houille. *Compt. Rend.*, vol. xcix., 1884, p. 200.

RENAULT, B., and ZEILLER, R. Études sur le terrain houiller de Commentry. Flore foss. *Bull. Soc. Indust. Min.*, vol. iv. [3], 1890.

RIGAUD, F. La formation de la houille. *Rev. Scientifique*, vol. ii. [4], 1894, p. 385.

SAPORTA, G. DE. La formation de la houille. *Rev. Deux Mond.*, 1882.

SHALER, N. S. General account of the fresh-water morasses of the United States, etc. *U.S. Geol. Surv.*, 10*th Ann. Rep.*, 1888-89, p. 261.

SOLMS-LAUBACH, GRAF ZU. (1) Fossil botany. Oxford, 1891.

SOLMS-LAUBACH, GRAF ZU. (2) Ueber Stigmariopsis, Grand' Eury. Pal. Abhand. Dames and Kayser, vol. ii., Neu. folg., heft 5, 1894, p. 223.

STERNBERG, GRAF VON. Versuch einer geognostisch botanischen Darstellung der Flora der Vorwelt. Leipzig, 1821-38.

STUR, D. Ueber die in Flötzen reiner Steinkohle enthaltenen Stein-Rundmassen und Torf-Sphärosiderite. Jahrb. k.k. geol. Reichs. Wien, vol. xxxv., heft. 3, 1885, p. 613.

TOULA, COL. F. Die Steinkohlen. Wien, 1888.

WETHERED, E. On the structure and origin of Carboniferous coal seams. *Jour. R. Mic. Soc.*, vol. v. [2], 1885, p. 406.

WILLIAMSON, W. C. (1) *Brit. Assoc. Report*, 1881 (York), p. 625.

WILLIAMSON, W. C. (2) On coal and coal plants. *Macmillan's Magazine*, vol. xxix., 1874, p. 404.

WITHAM, H. T. M. The internal structure of fossil vegetables. Edinburgh, 1833.

ZIRKEL, F. Lehrbuch der Petrographie, vol. iii. Leipzig, 1894 (edit. ii.).

A. C. SEWARD.

ON DIGESTION IN THE CŒLENTERA.

THE science of Comparative Physiology is one which has not yet received the attention which it deserves from those engaged in biological investigations. The facts of the anatomy and development of a large number of animals are now well known, but we are still in possession of very little information concerning the physiological processes of digestion, respiration, circulation and the like of the commonest and best known creatures which are dissected in our laboratories.

A special word of welcome, therefore, must be given to any piece of careful and conscientious work in this line of research, and the hope expressed that the work will be continued and extended.

The subject to which some attention has been paid during the last few years, and in which it may be said some little progress has been made, is that of the digestive processes in the Invertebrata.

Although the investigation received its most important stimulus from the researches of Metschnikoff on the digestion of various groups of invertebrata, the interest has been somewhat concentrated of recent years upon the endeavour to determine accurately the physiology of the digestion of Cœlentera, and it may be of some interest to the readers of this journal to have in the form of a short essay some account of the more recent investigations on this branch of the subject.

In the year 1880, Metschnikoff proved that the endoderm cells of many hydroid polyps, sea-anemones and other Cœlenterates possess the power of throwing out processes of their protoplasm, embracing particles of carmine and the like, and thus incorporating them into their substance. These particles of carmine are not of course digested by the endoderm, but the conclusion was drawn that the cells have in like manner the power of enclosing

small particles of food and digesting them within the cell-substance, just as an amœba is known to catch and digest its food particles.

The process of digestion within the cell-substance, or "intracellular digestion," was subsequently discovered by Metschnikoff and other observers to occur in the intestine, or in certain regions of the intestines, of other Invertebrates, and may be said to be now recognised as a normal method of digestion in Cœlentera, in many worms, and probably also in other groups of animals.

This fact being established, the next questions which arose were: Is this the only method of digestion in Cœlentera? Does no digestion take place in the cavity of the polyps? Is there no extracellular digestion? The first question had to be answered in the negative, and the last two in the affirmative. No one who has seen a Hydra catch and devour a large daphnia can doubt for a moment that some fluid is brought to bear upon its tissues which leads to their rapid disintegration, and to assert that this process occurs within a single endoderm cell, or plasmodium of fused endoderm cells, would be erroneous and ridiculous.

The next stage in the history of the investigation was reached when Lankester, in 1881, published an account of his researches on the digestion of Limnocodium and the structure of its endoderm.

Limnocodium is the name given to the interesting little freshwater medusa which periodically makes its appearance in the Victoria Regia tank in the Botanical Gardens in Regent's Park. The mouth of this delicate little creature is situated at the end of a quadrangular tube suspended from the centre of the under side of the disc. He found that the endoderm lining the walls of the cavity of this tube or stomach presents three principal forms, which occur in the oral, the mid-gastric and the proximal regions respectively.

Intracellular digestion was observed in the proximal region only; small unicellular organisms being enclosed in the substance of the cells, some apparently unaffected and others in various stages of disintegration and dissolution.

In the oral region of the stomach the endoderm was of a different character and never contained food particles. In those forms which were, in all probability, in a hungry condition, numerous large clear goblet cells were observed, which were shed apparently in the specimens captured in the act of digestion.

The conclusion was therefore drawn that, in addition to the ordinary process of intracellular digestion, a secretion may be poured into the cavity of the stomach from the goblet cells, or secretion cells as they were more correctly termed, which probably exerts some digestive action upon the larger forms of prey, *outside* the cell-layers.

In other words, in addition to the process of intracellular digestion, there is a process of extracellular digestion, the latter being perhaps only preparatory to the former.

A few years later Jickeli and Nussbaum described in the endoderm of Hydra, in addition to the ordinary large vacuolated cells, certain smaller forms which were called gland cells.

A physiological investigation of these cells led Miss Greenwood, in 1888, to the conclusion that the digestion of the food of Hydra takes place entirely outside the endoderm cells, that the small pyriform bodies found in gland cells are poured into the body cavity during digestive activity in the form of a fluid secretion, and that the products of digestion are taken up by the large vacuolated cells in a fluid form for storage and subsequent distribution.

These results, then, though differing in some minor points from those obtained by Lankester in Limnocodium, confirmed his conclusion as to the secretion of a fluid into the cavity of the Hydroid by certain cells of the endoderm.

Further evidence upon this point was obtained by Hardy, who made an elaborate investigation of the endoderm of Myriothela phrygia. He found that the food of this Hydroid, which consists chiefly of small Crustacea, is digested at first in the lower portion of the tentacle bearing region where the gland cells are most abundant, and is due to a digestive fluid poured into the cavity and secreted by

those gland cells. The result of this digestion is the disintegration of the food into a number of fragments which float freely in the fluid of the cavity, and the solution of a considerable quantity of the proteids of the prey which may be precipitated by treatment with corrosive sublimate. It was further shown that many of the fragments are taken up by the endoderm cells and digested within the cell substance, whilst the vacuolated cells of the endoderm become loaded with granules—the so-called nutritive spheres—which are formed from the products of digestion in solution in the cœlenteric cavity.

The general results of these investigations have proved then that in the Hydroids two kinds of endoderm cells occur, namely, secreting gland cells and vacuolated cells for the absorption and storage of the product of digestion in the fluid form, and that in some Hydroids, but not apparently in Hydra, the intracellular digestion of a portion of the food may occur.

In the Hydrozoa the cavity of the body is simple and continuous, and although different regions may be defined in which the two or more varieties of endoderm cells may be predominant, no special digestive organs of definite shape can be recognised upon simple dissection and examination with a lens.

In the Anthozoa, however, a more complicated structure is observed. The mouth opens into a short tube, which is ectodermic in origin, called the stomodæum, and this is connected to the body wall by a number of partitions or mesenteries lined on both their surfaces by endoderm cells. Their free edges are somewhat convoluted, are provided with a thickened epithelium, and are termed the mesenterial filaments.

The question then naturally occurs: "Have we in this more complicated structure some separation of the cells which in the Hydrozoa perform the functions of digestion?" Or to put the same question in other words: "Does the epithelium of the mesenterial filaments perform the function of secretion or absorption only, and the remainder of the endoderm lining the body walls and mesenteries the

supplementary one, or are the functions referred to not confined to any one region or set of organs in the Anthozoan anatomy?"

Concerning the function of the stomodæum we have very little experimental evidence.

The Hertwigs and others have shown that the epithelium lining the inner walls does contain among the columnar ciliated cells of which it is mainly composed a certain number of gland cells which are histologically of two kinds, but to what extent these cells assist in the digestion of the food has not been experimentally determined.

In the Alcyonaria no gland cells are found in this region, and it seems probable that the stomodæum in all Anthozoa is simply a food passage, and plays, at most, a very small part in the process of digestion. In all Anthozoa, however, the epithelium of the mesenterial filaments—with the exception of the two dorsal ones in Alcyonaria—is crowded with gland cells, and there can be no doubt that they secrete a fluid which disintegrates and dissolves the food.

When the food has passed through the stomodæum, it may be seen in certain transparent polyps to be seized by the filaments and held in their grasp until it is disintegrated and partly dissolved. Krukenberg described the filaments of sea-anemones as being wound about the food, and Wilson found that in Leptogorgia virgulata—an Alcyonarian—the food was "held closely clasped by the mesenterial filaments for two or three hours," and that afterwards "a mass of refuse matter was passed out through the œsophagus," *i.e.*, stomodæum, "and the filaments resumed their normal position".

There can be little doubt, then, that these organs do secrete a digestive fluid in the Alcyonaria, and there can be little doubt that the gland cells which secrete this fluid are chiefly confined to these filaments. But is the absorption of the food either in a fluid state or in a particulate form confined to the cells of the filaments, or to the cells of the general endoderm lining of the body cavity, or does it occur

in both the filaments and the general endoderm? Upon these points there is conflicting evidence. Wilson and others found certain diatoms and other foreign bodies embedded in the epithelium of the filaments, and failed to find them in the endoderm cells of the mesenteries and body wall, and consequently the former came to the conclusion that probably "the digestive functions are performed by the entodermic filaments alone, and never by the ectodermic filaments or the general entoderm".

A little consideration, however, would have led the American observer, one cannot help thinking, to a different conclusion; for he himself and the writer of the present article, working quite independently of one another, discovered that a regular circulation of the fluids of the cœlenteron in Alcyonaria is effected by the long cilia of the groove on the ventral side of the stomodæum producing a current from without inwards on the one side, and by the cilia of the dorsal or ectodermic filaments producing a current in a reverse direction on the opposite side of the cœlenteron.

Now such a current, constantly at work, must immediately drive the fluid products of digestion away from the region of the filaments, and they would consequently be entirely lost to the animal unless they were absorbed by the general endoderm. Moreover, it is difficult to understand how the lower parts of a massive colony such as Alcyonium could receive any nourishment at all if the absorption of the food occurs only in the filaments, unless indeed we suppose that nourishment may be handed on from cell to cell for two or three feet of endoderm.

Some recent investigations of Willem on the digestion of sea-anemones leads us to the conclusion that the absorption of the food is chiefly, if not solely, confined to the general endoderm, the epithelium of the mesenterial filaments taking but a small share in it. By feeding certain anemones with carminated albumin, or with finely chopped liver of mussels, the yellowish-brown fatty globules of which can be easily recognised in the substance of the cells, and then examining the endoderm by a lens or by

means of sections, the German observer was able to prove that both on the mesenteries and the general body wall the endoderm cells do swallow, probably in an amœboid manner, the food that is given to them in a finely divided state.

The general results obtain by Willem have been confirmed by Chapeaux, and our knowledge of the process of digestion extended by an investigation of the chemical character of the digestive fluid secreted by the endoderm, and its effect upon the food material.

Chapeaux found that when the anemone Adamsia is removed from the shell on which it lives, it emits a liquid which contains a number of refracting vesicles and fine granules. This liquid is distinctly more alkaline than sea-water, and is capable of digesting fibrin and emulsifying fats but exercises no action upon starch and cellulose. The extracellular digestion then is due to a ferment which acts in an alkaline medium.

When particles of litmus are injected into an anemone they are greedily taken up by the endoderm cells and acted upon by some acid secretion within the cell-substance. When olive oil is injected it becomes rapidly emulsified, and in the course of from five to twelve hours the endoderm cells become gorged with fatty granulations. Small particles of fibrin are in like manner taken up by these cells and rapidly digested. The intracellular ferment, however, does not, according to Chapeaux's investigations, effect any change in cellulose, and fragments of Cladophora and Ulva are rejected intact after remaining twelve hours in the cœlenteron.

Chapeaux is of opinion that the mesenterial filaments as well as the general endoderm take part in this process of intracellular digestion, but his statements on this point are not accompanied by any figures, and must be received with caution.

The results of Chapeaux's investigations, that there is an extracellular alkaline digestion of fibrin on the one hand, and a subsequent intracellular acid digestion of fibrin on the other, are undoubtedly of great interest, and will, it is to

be hoped, lead to renewed interest in this subject; but in many respects his paper is unsatisfactory. His statement, for instance, that the digestion of the gastrozooids of the Siphonophore Praya is solely intracellular is inconsistent with our knowledge of the processes of the digestion and minute anatomy of the endoderm of Hydroid polyps, and it is surprising that it should be made without some reference to the work that has been done by other naturalists in this group. The paper would have been of greater value too if it had been accompanied by some illustrations of the process of intracellular digestion in the general endoderm and mesenterial filaments of the sea-anemones.

A great deal still remains to be done before it can be said that we have a really clear and satisfactory account of the digestion of the Cœlenterates.

It seems to be established now that an alkaline fluid is secreted into the digestive cavity of Cœlenterates which is capable of emulsifying fats and converting proteids into peptones, that a process of intracellular digestion also occurs which is accompanied by an acid secretion, and that in that process proteids are converted into peptones, fats saponified, and starch granules dissolved. But there is still some doubt as to the form in which the soluble products of digestion are taken up by the endoderm, are stored for further use, and distributed through the organism.

Valuable results might probably be obtained by an investigation of the histology of the endoderm and physiology of digestion in one of the large medusæ which occur upon our coasts, in which the gastral pouches give rise to fine canals distributed over the umbrella. It would be interesting to learn in what respects the endoderm in the marginal ring canal differs from that of the pouches, and in what form it receives its nourishment. These and other points, it is hoped, will soon be taken up, and our knowledge widened of this interesting and important branch of comparative physiology.

BIBLIOGRAPHY.

CHAPEAUX. Sur la digestion de Cœlentérés. *Arch. Zool. Exp.*, I, 139, 1893.

WILLEM. L'absorption chez les Actinies le origine des filaments mésentériques. *Zool. Anz.*, xvi., pp. 10-12.

GREENWOOD. Intracellular digestion of Hydra. *Journal of Physiology*, ix.

LANKESTER. Limnocodium. *Q. J. M. S.*, xxi., p. 127, etc.

WILLEM. Tentacles of Apolemia. *Bull. Ac. Soc. Belg.*, 54, pp. 354-63.

HARDY, W. B. On some points in the histology and development of Myriothela phrygia. *Q. J. M. S.*, October, 1891.

SYDNEY J. HICKSON.

FOLDS AND FAULTING: A REVIEW.

PART II.

IN the year 1884 Bertrand proved that in the region of Provence similar overfoldings or overthrusts had been produced. Renevier worked out the region of the Savoy Alps, and the country above Bex, the enormous overthrow on the Dent de Morcles becoming a standard feature in geological literature, while Schardt, by his work on the Pays d'Enhaut (10), carried us still further into the field of geological speculation. In this paper several suggestions are given, which it may be well to bear in mind. It had been asserted, more especially by Lory, that there were evidences that part of the Alpine movements, the final results of which we have already discussed, had commenced prior to the main elevation, and it is interesting to find here a case introduced, where an Eocene conglomerate, the Hornfluhgestein, contained fragments of the malm rock, of which the chains of the Rubli and Gummfluh are composed. Hence Schardt concludes that these mountains were at that time in process of formation, and formed cliffs in the Eocene sea.

Further, in the Flysch formation of this region occur a large number of blocks of exotic origin, consisting of mica-schists, talc-schists, chloritic protogine, and calcareous fragments, as also in adjacent parts, biotite-granites, quartzites, and gneisses. This indicates that in pre-Miocene times an extensive crystalline region existed, either as a continent or an island, which may even have served as the fountain-head of a not unimportant glacier, the rocks being in most cases similar to those at the present time brought down the Rhone Valley by the glacier, or distributed by the river.

It is also pointed out that whereas in the same chain any group of strata from the Lias upward has the same facies, in the chains next succeeding it has generally a different character, thus proving that submarine inequalities

must already have existed at an early period, even at the end of Liassic times.

The importance of these questions, in so far as they bear upon the existence of a distinct crystalline massif in Eocene times, will be obvious.

The main conclusion he deduces is, that from the Jurassic times onwards the submarine inequalities were already distributed in directions parallel to those of the existing chains, and that the direction of the folds had already been determined at the close of the Liassic period.

Whilst in Heim's work attention is more especially called to mountain folding as a whole, in this work now under consideration the effects of pressure on strata of different consistency are more immediately considered.

In the Pays d'Enhaut the conditions are particularly favourable for this purpose, a great mass of Jurassic and Cretaceous limestones being enclosed between Liassic marls and Eocene shales, and an examination of the pre-Alpine range reveals the fact that not merely has there been a folding of the whole, but also a differentiation of movement as regards rocks of varying composition. The Eocene beds appear to have been compressed against the Jurassic limestone strata, and as a result the former are not only vertical, but even bent back at the point of junction, the older and harder beds being thrust over the younger series.

M. Lory having in his work (11) expressed his opinion that faults preceded folds, M. Schardt re-examined the evidence, but arrived at conclusions of a diametrically opposite character. He found faults to be in the closest union with foldings, and that not infrequently faults and arches alternately replace each other; that simple vertical faults are purely superficial, never attaining any great depth, and that now dislocated overfolds are rare, owing to the great movement which the pre-Alps have undergone. Faulting is mainly represented by true, or, it may be, *anticlinal overthrust*, the one limb of an arch being thrust over the other, the throw in some cases exceeding a thousand metres. He says: "It seems certain that the overthrust of the Gastlosen chain, extending as far as the Laitmaire, is formed from a pre-

existing arch, which has not succeeded in developing itself, because it was overlaid by an enormous mass of Flysch formation, and it has therefore been disjointed, and transformed into an anticlinal overthrust".

Lateral overthrusts are more limited, and are due to the sinking of one side of an arch, the downward movement being compensated by the contortion of the marly beds forming the core of the overlying fold. In *Isoclinal overthrusts* one of the parts is so covered by the other that the beds in both appear to be nearly parallel, and where harder beds overlie softer ones, experiment has shown the possibility of a synclinal break ; one of the composing anticlinal limbs being so broken as to produce an underthrust into the softer beds below (see plate ix. of above work). The final result of these studies has therefore again been to confirm, in his opinion, in a great measure Heim's views that overthrust faulting as the result of folding is a predominant rule in mountain structure.

On the basis, therefore, of a number of ascertained facts, in 1886 a very considerable amount of materials had been collected, and certain broad generalisations announced. It had been shown that mountain structure is not merely local, but the result of a movement affecting a broad belt around the globe, a considerable surface being involved, which has a distinct flow structure in a certain direction, giving rise to faults and sinking areas in the rear. That the whole of this broadly separated region has been folded and contorted, every part of the area being more or less affected by the movement, though the central portions have undergone the greatest flexuring. That normal faulting, as such, has played but little part in mountain structure ; the fan structures, and overthrust folding or faulting being in the main resultants of lateral compression. That the formations of the valleys and outlines of the peaks have been entirely the work of erosion and denudation acting through prolonged periods, whilst the variations in the character of strata have given rise to all the complexities of detail which for so long a time rendered the Alpine regions a geological puzzle. It has also been ad-

vanced that in numerous cases the production of mountain masses has been preceded by the deposition of great thicknesses of marine strata, thus giving weight to the theory that a close connection exists between mountain elevation and a geo-synclinal. Yet scarcely has a rule been established, or an absolute tectonic creed promulgated, than fact upon fact pours in, either to shake our faith, or test our infallibility. Nothing seemed more certain than that the Plutonist School had suffered complete defeat and annihilation, yet in 1877 Gilbert (12) proved that there are great intruded laccolites, extending many miles in a horizontal direction, and that the stratified deposits overlying them have not only been carried upwards by this vertical movement, but have been raised a height of 5000 feet without a trace of fracture, so that Von Buch's generalisation failing to account for the greater, having been proved essentially applicable to the lesser, and vertical pressure once again claims its place as one of the formative agents in mountain formation.

Should we, again, be prepared to submit that, with the exception of mountains formed of volcanic materials erupted along a line of fissures, tangential compression has alone been active, and that mountain ranges must of necessity exhibit the complicated foldings referred to, we must again halt, seeing that a region is now known in which folding, as such, is entirely absent, Dutton and Powell having shown that the High Plateau of Utah, and the Uinta Mountains have been formed by faults, whose vertical throw has, in some cases, exceeded 7000 feet, and instead of the strata being waved, steep "monoclinal flexures" are produced.

Do we hold that folding is in the main essential where lateral pressure is active, we are face to face with Lory's assumption that faulting must be the precedent condition ere folding can be set up in mountain ranges.

What we must now ask ourselves is—whether, in the face of all these apparent counter-movements, the broad principles of folding have been affected, and lost their power or influence? Whether their fruitfulness in suggestion is exhausted, or whether their theoretical basis is strong

enough to bear the weight of a broader, and perhaps grander, super-structure? Hitherto a large gap had existed in the material upon which a wider conception could be based. The oceans themselves hid their secrets from the gaze of the anxious inquirer, and the greater portion of the solid earth crust lay unknown and uninvestigated beneath the wave. The numerous soundings made in cable expeditions, the various national deep sea enterprises, and, above all, the investigations of the *Challenger* Expedition, have at length, to a great extent, lifted the veil, and every branch of science has received an impetus which will not be exhausted for many years.

The occurrence of inequalities in the sub-oceanic area were found, not to be capricious and local, but as extensive as the great belts of elevation which gird the continents. Volcanic activity was seen to be in close relationship with the great earth features, and a wealth of material has been added to our knowledge of the fauna, temperature and character of the deposits in the great marine areas.

The conception and combination of the highest development of fold geology, and the new truths regarding our earth's geography, have been left to one of our own countrymen, Professor Lapworth, who, in his addresses to the British Association, the Royal Geographical Society, and the Geological Association, has urged his views with all the energy and fire of an unbounded enthusiasm. No longer are we dealing with mere local highlands, no longer even with belts of mountain elevation, but with one great earth fold, of which the continents, including the Atlantic basin, represent the arch, and the deep depression of the Pacific, the trough; whilst between them lies the septum, a belt of unrest and continual disturbance, that "terrestrial ring of fire," as Professor Lapworth describes it, which, from Sumatra to Chili, borders the greatest of the earth's oceans.

Geologically, there can be no grander conception than this, and geographically its unity and simplicity arrest the attention, and impress the mind. This great fold reveals itself as composed of minor folds, to which the same rule

applies; arch and trough following each other in regular sequence, such as the arches of the Rockies and the Appalachians, with the simple trough of the Mississippi between them, or the two depressions of the Atlantic, with its central ridge, on whose steep gradients are situated the volcanic islands of St. Helena and Ascension, the Madeiras, and the Azores. And so on through the two-ridged continent of Africa, with its central table-land between; the Indian Ocean, with its double trough; and, finally, the Australian continent, flanked by its two ranges, the eastern and the western.

But the complexity proves even greater, the earth being regarded as triple folded in two directions; thereby explaining the more prominent of its geographical features. Geography has given convincing answers to questions first raised on geological bases, and we are led step by step from the world-wide conception of the fold through the minuter, but no less striking, foldings, as represented in highlands and mountains, down to possible changes of ultra-microscopical dimension.

But the extension of this theory, explaining, as it does, to the satisfaction of its author every great depression and elevation on the earth's surface, demands a far wider application in dealing with the past history of our globe. There again Professor Lapworth has not hesitated to apply his method, and he postulates that, in opposition to the views held by many distinguished observers, affirming the absolute permanence of ocean basins and continental structures, there is strong evidence that our islands, for instance, have undergone successive stages of elevation and depression, the alternation between the two extremes being marked by periods of great volcanic activity, as, for example, in Ordovician and Miocene times.

A question of great importance now presents itself, *viz.*, whether these foldings are the result of mere accidental disturbance, possessing no fundamental sequence? and Professor Bertrand (13), in seeking an answer, has inaugurated an interesting discussion.

The three main problems which he has endeavoured to solve in his work on the Paris Basin are:—

(1) Whether the Tertiary folds follow the direction of the primary ones, to which they are superposed?

(2) Have these folds been formed progressively in consequence of continuous, or slightly superadded, movements? and—

(3) Whether the system of main foldings is accompanied by one of perpendicular crumpling?

The method pursued by him is full of interest, and capable of wider application. Starting on the assumption that the Cretaceous beds have been deposited on an approximately level surface, a plane of marine denudation, he concludes that wherever these overlie the *junction* of two Jurassic beds that spot must have existed on the junction line when the Cretaceous beds were laid down. Obtaining, therefore, a series of such points over a given area, he is at length able to trace out a map of that district as it must have appeared in pre-Cretaceous times, and the study of such a map reveals the character of the foldings ere the Cretaceous beds were deposited, as also the relations of the outcrop of the Jurassic strata to the approximately horizontal surface. Then taking a contoured map of the country under investigation, and obtaining the present height of the base of the Cretaceous in different localities, it will be seen that it is possible to follow the direction of the ridges and troughs produced by post-Cretaceous movements, the result of the application of these methods being to prove the important fact that the post-Cretaceous folds are exactly superposed on the pre-Cretaceous: this result, the professor believes, will also hold true when the Jurassic and Palæozoic strata shall have been more closely considered.

His general conclusion (p. 146) is that folds are always formed on the same spots, and that a general design, marked out already at the beginning of geological time, has presided over the deformation of the earth's crust.

Our author, however, does not consider that folds alone are sufficient to account for all the varied features of the earth's surface. He is of opinion that, together with them, there are elliptical portions of its crust which undergo eleva-

tion and depression, such movements not being continuous on the same spot (as with folds), but ofttimes developing more rapidly than folding, and that these areas of movement, or, as he terms them, Domes, are the originating cause of most normal faults, which are therefore due as much to elevation as depression.

The year 1892 has been conspicuous in the annals of tectonic geology, the works of Lapworth, Bertrand, and the publication of the second edition of Suess' *Antlitz der Erde*, marking prominently the direction along which the tendencies of geo-tectonic conceptions are proceeding, and in this same year Bertrand (14) reviewed mountain structure as a whole.

Recognising mountains to be folded zones of the earth's crust, he lays special stress upon the continuity of such regions throughout the old continent, and argues that they are the result of the crushing of wedges of the earth's sphere. He notes that in Eurasia three marked regions or belts have been traced out, the most ancient being the one nearest to the pole; of these belts, in the most southerly (the Alpino-Himalayan), even the Miocene strata have been affected by the movement; south of the line of coal measures, extending from Wales to Westphalia, is a second belt, in which all the palæozoic rocks are folded, and, north of that same line, a still older one, in which only the pre-Devonian have undergone that process. He therefore concludes that the oldest zones are those nearest to the pole, and, from the discordance observed in the most ancient series of rocks in the northern regions, is of opinion that it was in the polar regions that occurred the first dislocations of the earth's crust, and that at a period of time, possibly, preceding the appearance of life upon the globe. He is further of opinion that the folding movement, which has been active throughout long periods, has been gradually shifting towards the equator, the most recent chains due to this movement forming an almost continuous belt around the globe, whilst the more ancient form a series of roughly concentric belts approaching nearer and nearer to the pole. He recognises, however, that, whilst these

conditions appear so well marked out on the northern hemisphere, they fail hitherto to explain the character of the southern.

Discussing the question of faulting in its relation to folding, he points out that faults are most frequent in the great plateaux, and in feebly undulated beds; and considers that these arise from the parts insufficiently supported from below yielding under the influence of gravitation; and that the relative play of the component parts, and the deeper sinking of some of them, may be referred to the influence of centripetal action arising from the secular cooling of the planet.

Again, in zones where folding is active, faults, if produced, are a resultant of that action, and it is along their lines of fracture that pressure continuing induces sliding; but only from below upwards, thus causing the superimposition of the older beds on the younger. These faults are therefore inverted, and in so far as they affect mountains, only occur in the exterior or sub-Alpine zones. On this hypothesis, therefore, the fold is the element, the principal phenomenon, and the fault a detail arising from its action. In the central parts of the chains, however, where cohesion is too strong to allow of faulting along any other line than that of stratification, gliding and slipping has only occurred along the lines of least resistance; the softer beds being crushed out, the harder ones would retain an apparent conformity in their stratification, but the general effect of the combined movements would be the thinning out of the whole series. It will thus be seen that in so far as it regards the horizontal displacement of an overlying fold, its being drawn out under the influence of continuous pressure, and the crushing and thinning out of the beds of the inverted arch, when the latter is completely superposed on the strata forming the trough, in all these points Bertrand is in complete accord with Heim.

The various theoretical deductions, however, which during the last fifteen years have so greatly influenced geological thought, have not passed unchallenged, and even

this year have been submitted to a searching analysis by Dr. Rothpletz (15 and 16).[1]

We do not propose to review in detail the former of these two works, or recite the various arguments he adduces in it, these being more concisely formulated in the second one (read at the late Congress in Zurich), which lead him to conclude that many of the theories advanced to account for mountain building have failed to explain to his satisfaction the phenomena produced; suffice it to point out that, in his opinion, they fail to explain Helmert's researches on the diminution of mass under mountain chains, and that most of the effects could equally well be the result of expansion as of contraction, by means of the radial and tangential pressures that would be set up.

Dr. Rothpletz, however, carefully guarding himself against accepting expansion as the solution, throws it out as a suggestion, seeing that he considers the theory of contraction has failed in one important particular, and that it is necessary to seek other bases more in accord with the facts known to us.

Summarising the conclusions he arrives at in his latest work, in which he has dealt with the whole question of overthrusts, we find many old views discarded, and new ones suggested.

On the first point, which will perhaps find very general acceptance, he formulates :—

(1) All overthrusts are the accompaniments of foldings and mountain elevation, and are the result of the same forces acting more or less horizontally, that is, tangentially to the earth's surface ; and that where tangential pressure is still active, it produces in local and somewhat sharply bounded regions compression and folding.

(2) That overthrusts in general have a strike closely parallel to the folds, and their dip, though, as a general rule, it is towards the mountain region, may occasionally be from it. In Daubrée's experiment (fig. 2) it will be seen

[1] This, pamphlet, read before the International Congress at Zurich, has only just been published, and I have been indebted to Professor Sollas for the loan of an advance copy.

that a rock prism submitted to lateral pressure undergoes elevation, and that the portion which passes outside the region of compression ceases to be acted upon, and apparently expands, giving rise to an overthrust on the surface, but at the same time fault planes are produced, along which the overthrusts are formed, having their dip inwards. This, therefore, he considers explains, not only the overthrust of the older beds over the younger, but also the occurrence of such on both sides of a mountain chain with their dips in opposite directions. Owing, however, to the very variable character of the rock masses, the simplicity of fracture displayed in this experiment is complicated by minor movements tending to hide the facts of development.

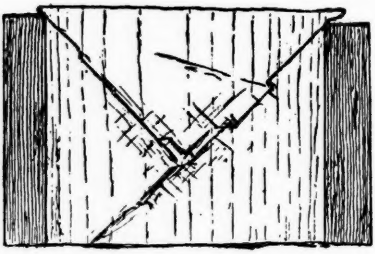

FIG. 2.—Illustrating the production of overthrusts along fault planes formed during lateral compression, as displayed in Daubrée's experiment.

(3) Although generally overthrust planes have the same strike as the folds, yet in some cases slight divergences from absolute parallelism occur. These are known from all regions, and show that though both are originated by the same forces, the folds were produced earlier, and the change of direction in the formation of the overthrust arises from increased compression caused by augmentation of the pressure action.

(4) The dip of the overthrust planes almost invariably differs from that of the strata or folds, sometimes merely cutting across a trough or saddle at an acute angle to the axis plane ; and at others so obtuse to that plane that they pass direct from an arch into the adjoining trough. This proves, therefore, that the effort which produced them is

independent of the fold movement. Though there may be isolated cases of absolute correspondence of the overthrust surface and the axis plane, yet the examples where the other conditions prevail are so much more numerous that they should be considered as exceptional and not in essential relationship.

(5) As a rule the strata both above and below the thrust plane are normal—that is, the younger overlie the older. When the thrust plane has a very feeble slope, and stratification is simple, the result is the repetition of the same series of strata; should, however, these be much dislocated and compressed into many folds, they are, apparently, more complicated, and the series may be repeated several times where folds are very inclined, lying sometimes on the thrust plane in a normal, and sometimes in an inverted, condition, this latter being invariable when the lower limb of a lying trough has been overthrust by the upper one. In cases where the thrust distance has not been an extended one, or the direction of thrust has been at a highly-inclined angle, the tectonic relations of the troughs and saddles are not completely obscured; but where the overthrust has extended several miles, and exceeds the breadth of the folds, and still more so, should the thrust plane be horizontal, then the original tectonic relationship will be scarcely recognisable, and the nature of the strata below and above the overthrust may be completely different in character.

(6) The rocks bordering the overthrust plane have in almost every case undergone mechanical and chemical alterations of an intense character. This ordinarily consists in the formation of coarse breccias or fine sands through disintegration of the rocks. Owing to chemical solution and recrystallisation, the breccia rock may differ markedly from that whence it was derived, polished planes and cleavage being produced, giving rise to structures such as fault rock, mylonite, etc., which are, all of them, more or less parallel to the thrust plane.

These structures may also, in many cases, be easily recognised as having been produced through the grinding of the constituents along a common friction plane, as when two

mountain masses are moving in opposite directions, and generally, recognisable fragments of the neighbouring rock are disseminated throughout the breccia; in some cases there is gradual transition from the one to the other, whereas in others, the boundary is sharp, or the breccia may be intruded into the parent rock in a series of tongue-like projections.

(7) The overthrusts often follow but one fault plane, though more commonly they have taken place along several, giving rise to a step-like formation (the Schuppen structure of Suess). It is possible, therefore, for a single overthrust to be broken up into a number of small ones, and *vice versâ.* We have also examples wherein the greater cut off the less, the former being known in the Scotch survey as major, and the latter as minor overthrusts.

(8) Though it apparently holds true that in every mountain chain overthrusts have occurred, in many cases they have not been abundant, their place being then taken by vertical faulting, due to the elevation of one side of the fault, this being the result of the same act of compression which produces the phenomena of overthrust; this condition is conceivable if movement coming from one side only should have resulted from the compression of the deeper earth-mass.

(9) It is difficult, however, under these circumstances to sub-divide faultings into (1) heaves, in which, by the means of pure tangential forces, horizontal movement alone without vertical displacement has been produced; (2) faults, due entirely to the action of gravity; and (3) overthrusts, due to a combination of tangential and vertical forces. In faults having a hade, the direction of the movement may be easily traced; but in such as are perpendicular it is difficult to determine whether the present position of the lower-lying beds has been reached through a sinking on their side of the fault, or is due to elevation on the other. Thus, in the Eastern Alps, troughs have been broken up in such a manner that the base appears to overtop higher portions of the trough limb, and it is uncertain whether it has risen, or the other sunk with regard to it (see fig. 106, *Geo-Tecktonische Probleme*). Similarly, the central part of an

anticlinal arch often appears to have sunk as regards its outer portion, but it is difficult to say whether elevation or depression has been the actual cause.

An appeal is made by the author that the conclusions should be tested on the basis of ascertained facts, and not on theoretical considerations, which, he maintains, should follow, rather than lead, the interpretation.

Applying his deductions to a consideration of the Doppelfalte (the central citadel of those holding overthrust to be overfold), he maintains that there is no evidence whatever of the existence of northern and southern return foldings, all the strata represented on Heim's figure (see fig. 1) in dotted lines being absent, while the Jurassic appears in the Rhine valley far north of the position of the point of outcrop necessary to support his theory.

Again, rejecting the theory of the northern middle limb, he argues that far from the Verrucano covering the Lochseitenkalk (representing the rolled-out Jurassic) at every spot along the thrust plane, there is in reality a series of broken folds of Jurassic and Verrucano strata at various points overlying the thrust plane, and adds that for the existence of the southern limb of the southern saddle there is no evidence whatever. Therefore the supposition that these members were present, but had disappeared through mechanical deformation and erosion, is purely hypothetical, and only advanced to explain stratigraphical relationships.

This, however, he considers unnecessary, believing that these relationships explain themselves simply; a highly-folded Eocene synclinal has been folded over from the south, and, from the north, older rock has been thrust over it along a very slightly inclined plane (see fig. 3), and further, that to the south of this synclinal the beds still in normal position have been trough-faulted, giving rise to the broad Rhine valley.

He is, therefore, of opinion that the hypothesis of double folding, with the squeezing out of the middle limb, is not only unnecessary, but opposed to facts. The appearance of longitudinal and transverse faults in many parts of the country is entirely foreign to the conception of folding

having taken place in the region without the production of faulting. (It may be here pointed out that Dr. Rothpletz argues that the Linththal is the result of a broad mountain region being faulted down between two parallel fault planes, whereas Heim holds that all the principal valleys are the result of continuous erosion acting through long periods.) The peculiar folding of the rock-mass, which has been pushed forward from the north, and cut off by the thrust plane, is inconsistent with the conception of a squeezed out middle limb (*Ost. Alpen*, p. 256). What, then, are the great principles which underlie this attack upon an apparently well-established theory? Folding, as the great basis of mountain building, remains unaffected, but that

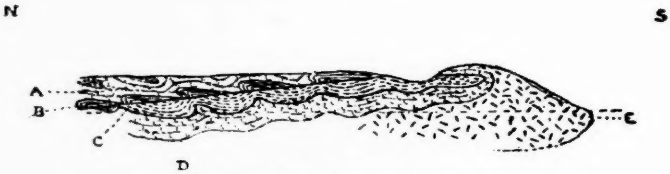

FIG. 3.—Illustrating Rothpletz's interpretation of the Doppelfalte.

A the Jurassic, and B the Verrucano members of the broken folds pushed along the overthrust plane, which is here represented by a dark line.

C. Eocene trough, contorted as in previous figure. (The curves have been simplified in the drawing.)

D. Jurassic member of the inclined trough.

E. Verrucano member of the inclined trough.

overthrusting is synonymous with overfolding is strenuously denied. The leaders of the New Geology have hitherto, to a large extent, held that folding and overthrust stand in the closest connection, whereas Rothpletz maintains that folding has preceded the overthrust, the latter frequently cutting right across the folds.

On the other hand our author considers that a close relationship exists between overthrusts and faults, and endeavours to show that where the former are scarce, normal faulting takes their place.

The points in Heim's theory that he specially attacks are: (1) The overfolding with squeezing out of the middle limb; (2) the conception of latent plasticity; (3) rock meta-

morphosis without faulting, and (4) he strongly insists that many of the principal Swiss valleys are the production not so much of erosion as of faulting.

In support of these views Dr. Rothpletz, in his latest work, has gathered together evidence from all the principal mountain regions. In the Linththal, opposing the view that folding has originated in the deeper-seated portions of the earth's crust without faulting, he maintains that great dislocation fissures occur which extend downwards into the deepest strata open to observation.

He also points out that where, according to the Doppelfalte theory, Jurassic Hochgebirgskalk was supposed to exist, in reality, the whole precipice consists of all strata from Eocene to Dogger, and instead of a simple inversion having here taken place (south fold of southern saddle, where the squeezed out middle limb is shown overlaid by Verrucano), the whole is folded into a series of troughs and arches, the Malm being in places folded three times on itself, sometimes enclosing Dogger and sometimes Eocene beds.

He describes a series of vertical to overturned folds in the Sentis region, cut through by inclined longitudinal fissures, along whose fault planes the upper side has been thrust over the lower. These overthrust planes follow in general the longitudinal direction of the folds, but they are never absolutely parallel with the strike of the strata, being mostly of greater inclination than the latter.

The overthrusts are clearly younger than the folds, cutting sometimes across the highly inclined, and at other times through the horizontally lying fold limbs, having no definite relation which would prove them to have been derived from the overfolding of the same. On the other hand the fault planes are clearly younger than either, and along them horizontal displacements and depressions have taken place, giving rise to all the varied mountain forms of the Sentis range.

In the Juras we again learn on Muhlberg's authority that the folds and overthrusts have not the same strike, and that the latter could not have been sufficient to squeeze out a middle limb 800 metres in thickness (this figure represent-

ing the amount of strata which would have to be affected by it). In addition the beds both above and below the thrust plane dip at a higher angle than the latter, and nowhere along the surface does any evidence exist of a squeezed out middle limb.

To account for these conditions our author again refers to Daubrée's experiment (fig. 3, and *Geo-Tecktonische Probleme*, fig. 41), submitting that instead of these great inversions originating under deep-seated conditions, they have in reality been formed in that part of the earth's mass no longer subject to continued compression. The occurrence of overthrusting only to the north of the Juras is accounted for, if these mountains be included as forming part of the Alpine system, seeing that the whole movement lies in the northern direction of the northern side of the main mountain axis, though exceptional conditions may arise, such as the southern overthrust in the Glarner Alps.

As additional evidence in support of his theory Rothpletz cites the Scotch area, and quotes from the *Report of the Scotch Geological Survey*, p. 411.

"There are two points, however, in the former official report, which, in the light of recent evidence, require modification. First, it was stated that during the incipient stages of the movements the strata were thrown into folds, which became steeper along the western front till they were disrupted, and the eastern limb pushed westward. The folds were believed to have culminated in reversed faults; but it is apparent that the latter need not necessarily be preceded by folding."

It is a remarkable fact with regard to Scottish thrust planes that not a single case of inversion of strata seems to be known, rendering, therefore, almost impossible any connection with original overfolding, and the suggestion is hazarded that lateral pressure having been active, the elevated mountain area has been thrust over a lower-lying plateau which occupied the region now hidden beneath the sea between the mainland and the Hebrides.

The Lausitz (Saxony), Westphalian, and Belgian areas are next considered, and although in the latter the results

are more highly complicated, owing to the original folding having been much masked by subsequent faulting, yet in the main the same general lessons are to be learnt. Rothpletz, in dealing with the district of Provence, lays special stress upon the fact that here also there is no absolute verification of the "squeezing out of the middle limb" theory. He considers that without its aid all the profiles may be explained, and that, in view of this uncertainty, it would be advisable to reject the term *pli-faille*, substituting for it one without theoretical signification, such as *pli de recouvrement*.

It cannot be doubted, however, that in this part of France folding and overfolding of the strata have been antecedent, and that subsequently and locally the folded masses have been thrust over each other along fracture surfaces inclined at a low angle; also most of the dislocations and depressions have taken place along fissures, which have affected both fold and overthrust.

Finally, he remarks that long since in America Professor H. D. Rogers had recognised the fact that overthrust could take place along a fault plane developed parallel to the axis plane of an anticlinal fold.

A review of the whole subject of mountain building reveals to us the existence of a number of conflicting opinions, attempting to explain by various methods a series of well-ascertained facts.

Even the main theoretical basis is by no means definitely settled, or universally accepted. Thus, while the greater number of observers are agreed to consider the slow cooling of the earth's surface, and its consequent contraction, as the chief cause of its present broad features, others, notably Mr. Mellard Reade, hold the view that expansion has played the most prominent part; that in regions of depression, where accumulation of sediments is continuing, there is a gradual rise of the isogeotherms as we descend; that from the expansion produced by this rise upper curvature of the underlying rocks will eventually be produced; and also that from the effect of this expansion on the overlying beds vertical movement will result, giving rise to the formation of mountain chains.

Putting aside, however, any further discussion of the views held by many most competent observers, we would, in conclusion, place in as sharp a contrast as possible the two broad principles which we have endeavoured to review.

The first, originally propounded by Heim, may be summarised: mountain structure is the direct result of folding. This has taken place far beneath the earth's surface, the rocks affected being, under the influence of enormous pressure, in a condition of latent plasticity, consequently faulting in the mass becomes impossible. Overthrust is the resultant of extreme overfolding, the middle limb of a fold being drawn and squeezed out between the arch and trough. Subsequently, erosion, having removed the great thicknesses of superjacent rock-masses, has revealed the folding, and at the same time caused the varied features of the mountain chains.

The second, of which Rothpletz is the exponent, formulates: folding is the first step in mountain building as a result of lateral pressure, but, as in Daubrée's experiment (fig. 3), on upheaval, part of the mass ceases to be affected by such pressure, great fault planes are produced, along which parts of the *already folded* beds are thrust over the younger ones. Overthrusts, therefore, are really faults of a special type; and the more normal form succeeding them determines the formation of valleys and peaks, lakes and precipices. The first connects overthrust with folding, the second with faulting. The one demands enormously thick overlying deposits and erosion acting through long periods; the other, no special conditions, and attributes the present features of the earth's surface mainly to faulting.

In the *Livret Guide*, issued to the members of the late International Geological Congress in Zurich, the Swiss geologists have endeavoured to explain the inner structure of the Alps. and no one can fail to be struck with the importance which the character of the deposits has had on the nature of the rock-foldings. In the section illustrating Schardt's Alpine excursion the *failles de recouvrement* are seen both to the north and south of the Pays d'Enhaut to have formed between the Eocene shales and the

Cretaceo-jurassic limestones, the former being highly contorted and underthrust, while the Jurassic limestones overlap them on both sides.

The questions demanding solutions are therefore of the most complex character; and only careful research in each mountain district, together with the widest application of mapping and physical and microscopical investigation, carried out by careful and indefatigable observers, can reveal the true interpretation of the facts with which we are now acquainted. It may be that as yet it is only grasped in part, and that the key to the tectonic problems has yet to be found; but by the conscientious working out of details a body of facts may be accumulated which will enable geologists in the future to determine the full significance of those phenomena whose effects are revealed to us under such varied and impressive forms.

BIBLIOGRAPHY.

(10) SCHARDT, H. *Bull. Soc. Vaud.*, ser. 2, vol. xx., p. 182, 1884-85.
(11) LORY. De l'Orographie des Alpes de la Savoie et du Dauphiné, p. 220, 1864.
(12) GILBERT. Report on Geology of the Henry Mountains, 1877.
(13) BERTRAND. *Bull. Soc. Geol., France*, vol. xx., ser. 3, pp. 118-165, 1892.
(14) BERTRAND. *Soc. Belge. Géologie*, tome vi., fasc. 1, pp. 13-28, 1892.
(15) ROTHPLETZ. *Geol. Querschitt. Ost. Alpen*, 1894.
(16) ROTHPLETZ. *Geo-Tecktonische Probleme*, 1894.

W. F. HUME.

NEOZOIC GEOLOGY IN EUROPE.[1]

TEKTONIC GEOLOGY.

IN an article which appeared in "SCIENCE PROGRESS" for June, a short account was given of the views of Bertrand on the structure of the French Alps. Since that article was written M. Bertrand has published his results in greater detail, and has plotted upon a map the anticlinal axes of the principal folds in this region (1). In general, the axes run from north-east to south-west, or from north to south, but in detail they are very sinuous. Even without taking into consideration the "amygdaloids" or "kernels" already described ("SCIENCE PROGRESS," vol. i., p. 323), there are a series of bends visible at many points. The direction of the river-valleys is closely related to the direction of the folds, but instead of running, as we might expect, in the lines of the folds, they run perpendicularly to those lines; and this is especially noticeable at the sinuosities. Bertrand attributes this peculiarity to the presence of a transverse system of folds, which is less important than the longitudinal, yet, on account of the isoclinal character of the latter, has a greater effect in determining the direction of flow.

Of the sinuosities in the lines of folding, by far the most striking are those around Petit Mont Cenis and the Grand Paradis. The axis of symmetry of these sinuosities corresponds with the valley of the Durance; and Bertrand points out that if we prolong the line of this valley above Guillestre we are led to the eruptive mass of Mount Genèvre, and thence to a series of similar sinuosities in the

[1] The term Neozoic is used in the sense in which it was originally proposed by Forbes—to include Mesozoic and Kainozoic. The present article is the direct continuation of the article on "Mesozoic and Kainozoic Geology in Europe," which appeared in "SCIENCE PROGRESS" for June, 1894.

folds on the Italian side of the Alps. There is in fact a kind of pinching in of the chain on this transverse line, and the folds of the two flanks approach each other. Moreover, as the various rock-zones of the Alps are traced from the north towards this line, they sink down below the surface (with the exception of the subalpine zone). Thus the line corresponds with a general transverse lowering of the whole of the northern part of the chain; and it is approximately parallel to the axes of folding in that portion of the range.

Bertrand believes that this feature is due to a large synclinal belonging to the same system as the folds to the north; and he looks upon the plain of the Po and the depression of the Canal du Midi in Languedoc as the easterly and westerly continuations of this depression. He believes, in short, that in Palæozoic times the chain of the Alps did not bend round, as it does now, to join the Apennines, but that it was continued with its original direction towards the Montagne Noire in Languedoc. The southern part of the chain is of later date, and the direction of the folds which produced it, is different.

The folds in the Alps to the north of the region investigated by Bertrand have been described by Haug (2), and from his account it appears that the axes of the folds do not run exactly parallel to the chain, so that as we pass along any one orographical zone we cross slowly from one system of folds to the one lying behind or in front of it.

Still farther to the north the structure of the Chablais has again been described by Lugeon (3). His views, however, have already been noticed in a previous article.[1]

In the Eastern Alps we have at last a section across the whole chain, from Tölz in the south of Bavaria to Bassano in the north of Italy. We owe it to Rothpletz (4), and it is the first complete section which has been attempted since the *Geologische Durchschnitt der Alpen von Passau bis Duino*, published by von Hauer so long ago as

[1] "SCIENCE PROGRESS," June, 1894.

1857. It would lead us too far to discuss this important work as fully as it deserves; but it is necessary to notice one or two points on which the views adopted by Rothpletz are by no means those which are generally accepted. On the much-debated question of the origin of the Schlern dolomite in Southern Tyrol, he sides with those who of late have attacked the views so strongly advocated by Mojsisovics. He believes that this great mass of dolomite owes its formation to algæ and not to corals.

On another question of general interest he has much to say. He discusses the work of Heim on the Glärnischer Alps, and comes to the conclusion that the double fold which figures so prominently in our text-books has no existence. The Lochseitenkalk which forms the middle limb of the northern fold in Heim's section, and which Heim believes to represent the Jurassic rocks dragged out, is according to Rothpletz nothing but a fault breccia, with a certain amount of vein material. The plane along which we find the Lochseitenkalk is a great thrust plane.

The most important result of a change of view of this kind is that it reduces very considerably the amount of contraction which it is necessary to suppose that the Alps have undergone. According to Heim,[1] in the Northern and Central Alps the beds which, folded as they now are, occupy a breadth of 82 kilo., would, if flattened out, spread over a width of 158 kilo. Rothpletz arrives at a very different result. The actual width of the Alps in his section is 222 kilo.; while, if the beds were unfolded, it would be 271·5. Thus the contraction is only 18 per cent., instead of nearly 50, as Heim's figures would give it. The two writers are treating of different areas, but Rothpletz believes that Heim's result is due to error in his interpretation of the folds.

The earth-movements which gave rise to the Alps took place at various periods. They certainly began in pre-Permian times, and continued at intervals until at least the Miocene period. In the Western Alps, near the

[1] *Mechanismus der Gebirgsbildung*, vol. ii., p. 213.

great bend of the Rhone above Geneva, Golliez (5) has brought forward evidence of pre-Carboniferous folds. The "cornes vertes" in the Dent du Mercles strike N.N.E. to S.S.W., and the Carboniferous rocks rest upon their upturned edges.

Leaving the Alps we must notice here a second paper by Bertrand (6) upon the various systems of folds throughout France. He still maintains the two laws which he has already attempted to prove; *viz.*, (1) that when once a system of folding is established, subsequent folds tend to be formed along the same lines; (2) that, in France at least, in spite of various sinuosities, the lines of folding form an orthogonal network. On the map which accompanies this paper the most conspicuous of the two systems of folds has a general east to west direction; but the lines, instead of being straight, are slightly curved, the concavity facing the north. This concavity increases as we proceed from the north to the south, and towards the Central Plateau it becomes double. The westerly concavity spreads down into the department of Ariége; the easterly again bifurcates, extending on the one hand into the valley of the Po, and on the other into Provence and the Alpes Maritimes. The second system of folds lies nearly at right angles to the first, but is very much less conspicuous.

As to the mode of formation of folds, Zürcher (7) has made some observations which are worthy of note. He believes, no doubt correctly, that a fold is not formed along its whole length at one time, but that it originates at one point and gradually spreads in two opposite directions from that point. And he concludes, on perhaps somewhat imperfect evidence, that the point where the folding is now most intense is the point where it first began to be formed.

Among papers dealing with special areas there is one by Tardy (8) upon the faults and folds in the Jura, which is, however, very brief and general in its statements. In the Corbières in Languedoc Grossouvre (9) has proved the existence of a thrust plane which he traces from St. Louis to Corbières, and which lies on the north side of the anticlinal which bounds the Albian basin of St. Paul de

Fenouillet. Lorenzo (10) describes in detail the folds in the neighbourhood of Lagonegro in the province of Basilicata in the South of Italy. The anticlinal and synclinal axes run, as might be expected, nearly north to south.

Salt deposits of the Basses Pyrénées.—In the South-west of France, near Bayonne, there are a number of salt-bearing deposits which have been the subject of considerable discussion. According to Seunes,[1] who has described the area in some detail, they belong to the Trias; but this view, which is based on their resemblance to rocks of known age in the Pyrenees, has not been universally accepted. Dufrenoy found Cretaceous fossils in them; and Macpherson has shown, by microscopic examination, that the Cretaceous marls of the neighbourhood are continuous with the "glaises bariolées" or salt-bearing beds. According to Gorceix (11) the salt deposits are all in close connection with the ophitic outbursts of the area. These ophitic outbursts took place along a number of lines which radiate from a point three kilometres west of Labastide Clairence, and which he believes to be faults; and the salt-bearing deposits occur upon these lines also, generally in fact where the ophite is exposed. When the Cretaceous Flysch occurs close to an ophitic outburst it is converted into "glaises bariolées," and he believes that the "glaises bariolées" served as basins in which the salt water of the sea collected. The salt water on evaporation, in which it was no doubt assisted by the warmth of the eruptive material, gave rise to the present salt deposits.

TRIAS.

The Triassic system in general has been made the subject of an interesting paper by Wohrmann (12). One of the conclusions at which he arrives is that the sediments of the German and Alpine Trias were laid down in connected seas and not in separate and distinct basins. He finds more species common to the North and South Alps than has generally been supposed. The most considerable eleva-

[1] *Ann. des Mines*, ser. 8, vol. xviii., pp. 209-458, 1890.

tions in the floor of the sea were the "vindelician" and Central Alpine ridges. The former stretched from Bohemia in a south-westerly direction towards the Schwarzwald. It made its first appearance in the Muschelkalk period, and reached its greatest development during the deposition of the Lettenkohl beds (Lower Keuper). The ridge of the Central Alps was in existence in Permian times, and became less prominent towards the end of the Keuper.

Concerning the value of zone fossils Wohrmann seems somewhat sceptical. He remarks that cephalopods do not lend themselves any more than other forms to the exact determination of single horizons; for they also are limited to certain facies, and disappear and reappear with those facies. He lays great stress upon "international" forms, that is, forms of wide distribution; because a wide distribution implies indifference to local conditions—or facies. After all, the ammonite palæontologist does not contend for more than this; but he believes that ammonites are international forms.

In another and a much more detailed paper (13) Wohrmann has given an account of the Raibl beds (a part of Mojsisovics' Carinthian) throughout the length and breadth of their extent. The term is one which has been used in various senses, or rather with various limitations. It was originally employed by Foetterle and von Hauer to designate a series of marly and calcareous beds which at Raibl lies between the ore-bearing limestone and the Dachstein limestone. Palæontologically, this does not form a convenient division, for the St. Cassian fauna still lived on in the lower part of the series, and it was in the middle of Raibl times that the invasion of foreign forms gradually drove out the earlier fauna. But the change was not a sudden one, and no definite palæontological line can be drawn; while lithologically, von Hauer's grouping is the most convenient, and is adopted by Wohrmann.

The following table[1] will show the general classification

[1] This table does not show all the elevations and depressions referred to in the text, but only those which are indicated in the Franconian deposits, as well as in the Raibl beds themselves.

of the Raibl beds, according to Wohrmann, and their relation to contemporaneous deposits in Germany :—

	Swabia and Franconia.	North Tyrol and Bavaria.		
Lower Keuper.	Lower Gypskeuper. Very few Muschelkalk species.	Gypsum and Rauhwacke or Ostrea limestones. Very few Cassian species.	Torer beds.	Raibl beds.
	Unimportant elevation.			
	Grenzdolomit.	Lower limestone bank.		
	Depression.			
	Lettenkohl group with a Muschelkalk fauna; clastic sediments with plant remains.	Cardita beds, with a Cassian fauna in the lower part and a mixed fauna in the upper; sandstones with plant remains.	Cardita beds.	
	Elevation.			
	Upper Muschelkalk.	Wetterstein Kalk.		

Immediately before the Raibl period a great amount of deposition took place, mainly owing to an extraordinary development of marine algæ, and the result was the formation of the Wetterstein and similar limestones. This was followed at the commencement of Raibl times by a general upheaval, which in the south was accompanied by volcanic eruptions. Sandstones were laid down along the vindelician ridge, while further to the south the deposits were more marly. In the Eastern Alps the corresponding beds are slaty, and the fauna is poor: neither the character of the fauna nor of the deposits shows the influence of neighbouring land, and we may conclude either that no rivers flowed in this direction from the Bohemian massif, or that the coast lay farther to the north than in the Western Alps.

After the deposition of these littoral sediments a sudden sinking took place, and limestones and dolomites were laid down, forming the middle division of the Cardita beds. It is in the neighbourhood of the vindelician ridge, where the

littoral character of the earlier deposits is most marked, that the contrast is most clearly seen. In the Southern Alps no definite line of division can be recognised.

This was followed by another upheaval, a more considerable one than the former; and it also was accompanied by volcanic eruptions in the south. The vindelician ridge rose again, and the Bohemian mass grew out towards the south. Marshy islands formed along the northern border of what is now the Austrian limestone Alps, and upon these islands grew the plants which are found in the Lettenkohl group.

Again a sinking took place, and the Torer beds were laid down both in the Southern and the Northern Alps. They are mainly calcareous and dolomite.

All these elevations and depressions appear to have been simultaneous throughout the area.

It has hitherto been held that in the lower division of the Raibl beds there were scarcely any fossils common to the North and the South Alps, but Wohrmann finds a large number of species which occur in both. As for the Torer beds, it has always been recognised that these were very much alike on the two sides of the Alps.

In an important paper on the neighbourhood of Lagonegro, Lorenzo (10, see also 14) has given us the final results of his examination of that region. The Upper Trias is represented by the following groups (in descending order):—

Haupt-dolomite with *Gervillia exilis*, etc.
Dolomite Limestones.
Siliceous schists with Radiolaria.
Limestones with siliceous nodules. *Halobia insignis*, etc.

The lowest group corresponds closely with similar beds in Sicily, which have been referred by Gemmellaro to the zones of *Trachyceras Aon.* and *T. Aonoides.*

The succeeding series is principally characterised by the abundance of Radiolaria, such as *Porodiscus*, etc. The dolomite limestone contains numerous Gyroporellas of the group annulatæ, *Posidonomya*, *Daonella*, etc.; and from its cephalopods is correlated by Mojsisovics with the zone

of *Protrachyceras Archelaus.* Finally, in the Hauptdolomite, all the fossils, except the abundant *Gervillia exilis*, are Raibl forms.

The other papers on the Trias may be dismissed in a few words. Kittl (15) has come to the conclusion that the Marmolata and other allied limestones of Northern Italy should he referred to the zone of *Trachyceras Reitzi*, and not to that of *T. Archelaus*, in which Mojsisovics placed them. He unites them with the Buchenstein rather than with the Wengen beds.

Bertrand (16), who until recently believed that the "schistes lustrés" of the French Alps were pre-Triassic, has now reverted to the original view of Lory that they are really of Triassic age.

A controversial paper by Bittner upon the Alpine Trias requires no more than mention for the present (30).

JURASSIC.

Among the Jurassic rocks there is but little to record. The fourth volume, by H. B. Woodward, of the very important work on the Jurassic rocks of England and Wales, has been published by the Geological Survey (17). But, from the nature of the case, it does not lend itself to the purposes of the present article. Attention may be directed, however, to the description of the various kinds of limestone. Many of the oolites have been formed by algæ of the *Girvanella* type, but this mode of origin is not admitted for all.

Abroad we have a note upon the Liassic limestone of the Oisans (Dept. Isère) in the French Alps (18); and another upon the boulders of East Prussia, with a description of a section at Popiliani on the Windau (S. of the Riga Sea), from which neighbourhood it appears that these boulders may have been derived (19).

CRETACEOUS.

The most remarkable of the Cretaceous deposits is certainly the chalk, which is indeed one of the most peculiar formations met with in any geological system. For many

years it was universally considered to have been formed in deep water, like the Globigerina ooze of the Atlantic floor; but this view received a severe shock when Gwyn Jeffreys stated that, from a consideration of the molluscan fauna, he would infer that it had been laid down in shallow water.[1] Since that time opinion has been much divided, and the evidence of the fauna has frequently been discussed. The subject has recently been approached from a different point of view by Hume (20),[2] who has devoted much attention to the chemical and microscopical examination of the rock. He shows that the amount of terrigenous material in the Cretaceous beds gradually decreases from the Upper Greensand to the Upper Chalk, and from this he infers a gradual sinking of the land and of the floor of the sea.

Even from the general character of the Cretaceous deposits alone, we may conclude that, in the Anglo-Parisian basin, land lay towards the north in Northern Scotland, and towards the west in Ireland, the West of England and Brittany, for the deposits towards those areas are sandy; and, moreover, the upper beds overlap the lower towards the west. A relatively open sea lay over Kent and the East of England. More detailed examination shows that the same general distribution of land and sea existed throughout the Upper Cretaceous period.

Beginning with the Upper Greensand, which is largely of terrigenous origin, Hume points out that it is over 100 feet thick in Dorset, and that it thins towards the north and east, and dies out altogether at Dover and Rochester, showing that the land from which the materials were derived lay towards the west. From the abundance of glauconite grains, as well as the character of the fauna, he supposes that this deposit was formed at an approximate depth of 150 fathoms. It was, no doubt, more distinctly littoral towards the west.

In the case of the Lower Chalk, on the other hand, in which the calcareous material is in excess of that derived

[1] *Brit. Ass. Rep.* (1877). Trans. of Sect., pp. 79-87.

[2] See also Hume, *Chemical and Micro-Mineralogical Researches on Upper Cretaceous Zones in the South of England*, London, 1893.

from land, the thickness decreases from east to west. It is 198 feet thick at Dover, 116 feet in the Isle of Wight, and only 10 feet in Devon, and even this 10 feet is partly sandy. Moreover, as the thickness decreases, the proportion of insoluble residue increases: in Kent there is only some 15 per cent., in the Isle of Wight 40 per cent. Both these circumstances again point to the fact that land still lay towards the west and the sea had deepened.

In the Middle Chalk the amount of insoluble material is still further reduced. It has fallen to two per cent. in the Isle of Wight, and four per cent. at Folkestone. In the Upper Chalk the proportion of residue is equally low.

If, then, we may assume that the insoluble residue was derived from land, and the calcareous material was formed in the sea, we have clear evidence of a nearly continuous depression of the sea floor and recession of the coast line—a few small fluctuations there were, but these are unimportant. And that this assumption is justified is shown by the fact that the beds in which insoluble residue predominates thin out towards the east; while those in which the calcareous matter is most abundant thin towards the west. Moreover, as the insoluble residue diminishes, the heavy minerals, such as zircons, which must have been derived from land, become first of all smaller in size and then disappear, and the glauconite grains disappear also.

The depth of the Middle and Upper Chalk sea must, therefore, have been considerably greater than that of the Upper Greensand sea; and this view is supported by the decrease in numbers of the gasteropods and the proportionate increase of monomyarian lamellibranchs. Hume also bases part of his argument on the Foraminifera, and his final conclusion is that the Upper Cretaceous was laid down in a sea at least as deep as the Mediterranean.

In questions of this kind, when the argument is based upon the assumption that fossil forms lived and flourished under the same conditions as their recent allies, it must always be borne in mind that such an assumption is open to grave doubt. There is nothing to prevent an animal from adapting itself to live under a new set of conditions

(for instance, at a different depth of the sea) without becoming so much altered as to constitute a new genus. In this connection it is interesting to notice some recent observations of the Abbé Bourgeat upon the Gault of the Jura (21). From a comparison of the faunas at several localities, he finds that the gasteropods and cephalopods flourished best where sandy materials were being laid down; while lamellibranchs preferred the quieter waters which were depositing clay. Moreover, the ammonites, as if to enable them to resist the shocks of the material among which they lived, acquired tuberculate shells.

At the same time it is worthy of note than in the Barrêmien of Châtillon-en-Diois, Sayn and Lory have found ammonites in a reef deposit among a series of limestones, where the conditions must have been very different (22).

It is well known that the chalk facies of the Cretaceous system does not spread over the whole of Europe, and that in fact it is confined to the more northerly parts and to Russia. The Upper Cretaceous sea of Northern Europe appears to have extended from the Anglo-Parisian basin eastward between the old central ridge of the Alps on the south, and the ancient rocks of Scandinavia and North Russia on the north. It sent an arm southward through France, which probably united it with the sea of the South of Europe. But even in this northern sea by no means the whole area was occupied by chalk. As we approach the old southern shore, for instance, in Saxony and Bohemia, the Upper Cretaceous loses its chalky character and becomes sandy. Within the Alps themselves there are a number of small areas of Cretaceous deposits of a still more littoral character. These are known as the Gosau beds, and appear to have been laid down in narrow gulfs, which ran southwards into the old alpine land. The exact correlation of these deposits is a matter of considerable difficulty, and has given rise to much discussion. A new examination of the beds in the Gosau valley itself has been undertaken by Kynaston (23). According to him the series is constituted as follows (in descending order):—

Upper Gosau beds.	5. Sandy marls, alternating, especially towards the upper part, with sandstones, grits and conglomerates. 4. Sandstones and flags, with some sandy shales.
Lower Gosau beds.	3. Bluish-grey marls, with some limestone; very fossiliferous. *Hippurites organisans*, corals, etc. 2. Estuarine series of the Neue Alp. 1. (d) Limestone with *Nerinæa*. (c) ,, *Actæonella conica*, etc. (b) ,, *Hipp. cornu-vaccinum*. (a) Coarse conglomerate, with grits, sandstones and marls.

In the Gosau district itself these beds rest upon Triassic rocks, but near Salzburg they lie upon the Gault, and must, therefore, be of Upper Cretaceous age. It is not possible to make a direct comparison of the Gosau beds with those to the north, but the fauna is very like that of the Corbières in the South of France. Toucas there recognises two Hippurite zones, the first containing *Hipp. cornu-vaccinum* in abundance, and the second with *Hipp. organisans* and *H. cornu-vaccinum*;[1] and Kynaston correlates his two zones with these. Toucas places his first Hippurite zone in the Upper Turonian, and his second towards the top of the Senonian; and Kynaston concludes that the Lower Gosau beds represent the upper part of the Turonian and the whole of the Senonian, while Toucas correlates them with the Senonian alone. The age of the Upper Gosau beds, in which very few fossils are found, must still remain somewhat doubtful, but they may represent the Danian of other areas.

Of other papers upon the Cretaceous it will not be necessary to say much here. In the Lagonegro district only the Apturgonian is represented (10). It there rests unconformably upon the Lias, and consists of limestones. In the Monte Consolino, near Stilo in Calabria, Bassani and Lorenzo believe that the limestone which forms the crest of the hill includes beds later than the Tithonian (24). Sacco introduces some emendations in the geological map

[1] It should be remarked that Toucas does not attach much weight to the presence of *H. cornu-vaccinum* and *H. organisans*. Both of these occur in both zones. *H. dilatatus* and *H. bioculatus* appear to be the forms most characteristic of the upper zone. Toucas: *Bull. Soc. Geol. France*, ser. 3, vol. x., p. 200.

of the Northern Apennines (31). Finally, Stuart Menteath (25), in a series of controversial papers, has attacked the views of Seunes upon the geology of the western part of the Pyrenees.

TERTIARY.

The most interesting of the recent observations upon the Tertiary deposits are those which have been made in the eastern parts of Europe. In Roumania and the South-west of Russia there is an extensive basin of Tertiary deposits of which mention has already been made in these articles. On the general map of Roumania a part of this basin has been coloured as Eocene, and this colour has been extended to include a series of conglomerates towards the Transylvanian Mountains. These were naturally enough grouped together on a preliminary survey, but Stefanescu has shown that they are really of various ages. Some of them contain *Cerithium disjunctum*, and belong to the Sarmatian; in others *Cerithium minutum* has been found, and these must be referred to the Second Mediterranean Stage; while others contain nummulites, and have been correctly placed in the Eocene (26).

The Upper Tertiary beds (Miocene and Pliocene) occupy a larger space than the Lower (Eocene and Oligocene). The Sarmatian, for example, may be traced at intervals along the southern flanks of the Transylvanian Mountains in Wallachia, and covers the greater part of Moldavia (27). In general the sequence closely resembles that in the Vienna basin. In Austria, however, there is a distinct gap between the beds with *Cerithium* (Sarmatian) and those with *Congeria* (Pontian).[1] For a considerable time it was supposed that a similar gap existed in the Roumanian Tertiary. In Bessarabia, however, Sinzow discovered an intermediate fauna, and to the beds in which this occurs, Andrussow has given the name of méotique. They consist of yellow-green sands with limestones and

[1] The Sarmatian is placed at or near the top of the Miocene. The succeeding Pontian beds are referred by some geologists to the Miocene, by others to the Pliocene.

clays, and the fauna is partly marine, partly freshwater, or even terrestrial. According to Andrussow, at the end of Sarmatian times the sea formed a number of basins, the water of which, originally salt, gradually became brackish and then fresh. The marine fauna slowly gave way to freshwater forms; and towards the beginning of Pliocene times the basins had become large freshwater lakes (28).

A general account of the younger Tertiaries of Roumania is given by Fuchs (29). In the mountains which lie between that country and Banat, in Siebenbürgen, there are a number of isolated basins of Tertiary rocks. They are characterised especially by the occurrence of lignite-bearing beds, with *Cerithium margaritaceum* and *C. plicatum*. The best known of these basins is that of Bahna, north of Vercierova, in which, besides the Cerithium beds, normal Leitha limestones are found and marine marls with a fauna precisely like that of Lapugy. The Cerithium beds themselves have usually been correlated with the Pectunculus sandstones of Hungary (Oligocene); but according to Fuchs, excepting the two Cerithia mentioned, not one of the fossils is Oligocene, while all, including the Cerithia, are known to occur elsewhere in the Miocene.

It is remarkable that the lignite beds are never met with in Roumania, except in these isolated basins. They are unknown in the true Roumanian basin, where we have the following succession:—

(e) Unio beds. *Unio*, *Vivipara stricturata*, etc.
(d) Psilodont beds. *Unio*, *Vivipara Alexandrini*, *V. Heberti*, etc.
(c) Congeria beds. *Congeria stromboidea*, etc., *Unio*, *Vivipara*, etc.
(b) Sarmatian.
(a) Salt-bearing beds. *Ditrupa incurva* occurs in an associated Nullipore limestone.

The salt-bearing beds are correlated with those of Wieliczka, and are placed in the Mediterranean stage; the Congeria beds represent not only the Congeria beds (Pontian) of Austria, but also the Lower Paludina beds; while (d) and (e) correspond with the horizons of *Vivipara bifarcinata* and *V. stricturata* in Austria.

The papers dealing with Tertiary deposits in other areas will be noticed in subsequent articles.

BIBLIOGRAPHY.

(1) BERTRAND, MARCEL. Études dans les Alpes françaises (Structure en éventail, massifs amygdaloïdes et métamorphisme). *Bull. Soc. Géol. France*, ser. 3, vol. xxii., pp. 69-118, pls. iv.-vi., 1894.

(2) HAUG, ÉMILE. Les zones tectoniques des Alpes de Suisse et de Savoie. *Compt. Rend.*, vol. cxviii., pp. 675-678, 1894.

(3) LUGEON. [Région de la brèche du Chablais.] *Arch. Sci. Phys. Nat.*, Compt. Rend. 66me Sess. Soc. Helv. Sci. Nat. à Lausanne, pp. 84-93, 1893.

(4) ROTHPLETZ, A. Ein geologischer Querschnitt durch die Ostalpen nebst Anhang über die sog. Glärner Doppelfalte, 268 pp., 2 pl. Stuttgart, 1894.

(5) GOLLIEZ. [Decouverte des anciens plissements précarboniferes.] *Arch. Sci. Phys. Nat.*, Compt. Rend. 66me Sess. Soc. Helv. Sci. Nat. à Lausanne, pp. 85-87, 1893.

(6) BERTRAND, MARCEL. Lignes directrices de la géologie de la France. *Compt. Rend.*, cxviii., pp. 258-262, 1894.

(7) ZÜRCHER, PH. Note sur le mode de formation des plis de l'écorce terrestre. *Bull. Soc. Géol. France*, ser. 3, vol. xxii., pp. 64-68, 1894.

(8) TARDY. Environs de Simandre (Ain). *Ibid.*, pp. 247-251.

(9) GROSSOUVRE, A. DE. Sur la géologie des environs de Bugarach et la Craie des Corbières. *Ibid.*, vol. xxi., p. 278, 1893.

(10) LORENZO, GUISEPPE DE. Le Montagne Mesozoiche di Lagonegro. *Atti Real. Accad. Sci. Napoli.*, ser. 2, vol. vi., No. 15, 124 pp., 2 pl.

(11) GORCEIX, CH. Note sur le bassin salifère de Bayonne et de Briscous. *Bull. Soc. Géol. France*, ser. 3, vol. xxi., pp. 375-393, pl. xii., 1893.

(12) WOHRMANN, VON. Alpine und ausseralpine Trias. *N. Jahrb.*, 1894, vol. ii., pp. 1-50.

(13) WOHRMANN, VON. Die Raibler Schichten nebst kritischer Zusammenstellung ihrer Fauna. *Jahrb. k. k. Geol. Reichs.*, vol. xliii., pp. 618-768, pl. xiii., 1893.

(14) LORENZO, GUISEPPE DE. Sulla geologia dei dintorni di Lagonegro. *Atti Real. Accad. Linc.*, ser. 5, vol. iii., pp. 309-312, 351-354.

(15) KITTL, ERNST. Die triadischen Gastropoden der Marmolata und verwandter Fundstellen in den weissen Riffkalken Südtirols. *Jahrb. k. k. Geol. Reichs.*, vol. xliv., p. 99, 1894.

(16) BERTRAND, MARCEL. Études dans les Alpes Françaises (schistes lustrés de la zone central). *Bull. Soc. Géol. France*, ser. 3, vol. xxii., pp. 119-162, pl. vii., 1894.

(17) Woodward, H. B. The Lower Oolitic Rocks of England (Yorkshire excepted). *Mem. Geol. Surv.*, The Jurassic Rocks of Britain, vol. iv.

(18) Termier, P., et Kilian, W. Sur un gisement d' ammonites dans le lias calcaire de l'Oisans. *Bull. Soc. Géol. France*, ser. 3, vol. xxi., pp. 273-277, 1893.

(19) Schellwien, E. Der lithauisch-kurische Jura und die ostpreussischen Geschiebe. *N. Jahrb.*, 1894, vol. ii., pp. 207-227, pls. iii.-iv.

(20) Hume, W. Fraser. The Genesis of the Chalk. *Proc. Geol. Assoc.*, vol. xiii., pp. 211-246, 1894.

(21) Bourgeat, l'Abbé. Remarques sur la faune du Gault dans le Jura. *Bull. Soc. Géol. France*, ser. 3, vol. xxii., pp. 355-359, 1894.

(22) Sayn, G., et Lory, P. Sur l'existence de lentilles récifales á Ammonites dans le Barrêmien, aux environs de Châtillon-en-Diois. *Compt. Rend.*, vol. cxix., pp. 381-383, 1894.

(23) Kynaston, Herbert. On the Stratigraphical, Lithological, and Palæontological Features of the Gosau Beds of the Gosau District, in the Austrian Salzkammergut. *Quart. Journ. Geol. Soc.*, vol. l., pp. 120-151, 1894.

(24) Bassani, F., and Lorenzo, G. de. Il Monte Consolino di Stilo. *Atti Real. Accad. Sci. Napoli.*, ser. 2, vol. vi., No. 8, 6 pp., 1 pl.

(25) Menteath, Stuart. Sur le gisement et la signification des fossiles albiens des Pyrénées occidentales. *Bull. Soc. Géol. France*, ser. 3, vol. xxi., pp. 305-324, 1893. Sur les fossiles crétacés de la vallée de la Nive (Basses Pyrénées). *Ibid.*, vol. xxii., pp. 359-365, 1894.

(26) Stefanescu, Sabba. L'age géologique des conglomerats tertiaires de la Muntenia (Roumanie). *Ibid.*, p. 229.

(27) Stefanescu, Sabba. L'extension des couches sarmatiques en Valachie et en Moldavie (Roumanie). *Ibid.*, pp. 321-330.

(28) Sidorenko, D. Les formations mio-pliocéniques en Russie. *Ibid.*, vol. xxi., pp. 369-374, 1893.

(29) Fuchs, Theodor. Geologische Studien in den jungeren Tertiär-bildungen Rumaniens. *N. Jahrb.*, 1894, vol. i., pp. 111-170.

(30) Bittner, A. Zur neueren Literatur der alpinen Trias. *Jahrb. k. k. Geol. Reichs.*, vol. xliv., pp. 233-380, 1894.

(31) Sacco, F. L'Appennino settentrionale (Appendice prima). *Boll. Soc. geol. Ital.*, vol. xii., p. 627, 1893.

Philip Lake.

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN JULY, 1894.[1]

Vol. xlviii. No. 283. *American Journal of Science.* (July, 1894.)

Penfield, S. L., Methods for the Determination of Water (pp. 30-38). *Gooch, F. A.*, and *Kreider, D. A.*, Detection of Alkaline Perchlorates Associated with Chlorides, Chlorates, and Nitrates (pp. 38-41).

Vol. xvi. No. 7. *Journal of the American Chemical Society.* (July, 1894.)

Miller, E. H., Succinimid (pp. 433-462). *Johnson, S. W.*, The Determination of Phosphoric Acid (pp. 462-465). *Smith, E. F.*, and *Wallace, D. L.*, Double Bromides of Palladium (pp. 465-468). *Venable, F. P.*, An Examination of the Chlorides of Zirconium (pp. 469-475). *Baskerville, C.*, Separation of Zirconium by means of Sulphurous Acid (pp. 475-476). *Dennis, L. M.*, and *Cushman, B. S.*, On the Analytical Properties of Iron Phosphide and Phosphate (pp. 477-485). *Andrews, G. F.*, Notes on Aluminium (pp. 485-487). *Field, W. D.*, Pyroxylin: Its Manufacture and Applications (pp. 487-498). *Gilchrist, P. S.*, Improvements in the Manufacture of Sulphuric Acid (pp. 498-500). *Shimer, P. W.*, Note on the Determination of Silica in Blast-furnace Slag (pp. 501-502).

Vol. xix. No. 220. *The Analyst.* (July, 1894.)

Chattaway, Pearmain and *Moor*, On the Composition of Cheese (pp. 145-147). *Chattaway, Pearmain* and *Moor*, Note on the Valenta Acetic Acid Test (pp. 147-151). *Jones, E. W. T.*, Turbidity Temperature of Oils and Fats with Glacial Acetic Acid (pp. 151-156).

Vol. lxv. No. 380. *Journal of the Chemical Society.* (July, 1894.)

Smithells, A., and *Dent, F.*, The Structure and Chemistry of the Cyanogen Flame (pp. 603-611). *Baker, H. B.*, Influence of Moisture on Chemical Change (pp. 611-624). *Smith, E. A.*, Notes on the Cupellation of Bismuth-silver Alloys (pp. 624-628). *Tutton, A. E.*, Connection between the Atomic Weight of Contained Metals and the Crystallographical Characters of Isomorphous Salts: a Comparative Crystallographical Study of the Normal Sulphates of Potassium, Rubidium and Cæsium (pp. 628-717). *Hooker, S. C.*, and *Wilson, E.*, Conversion of Ortho- into Para- and of Para- into Ortho-quinone Derivatives. III. The Hydroximes of the Lapachol-group (pp. 717-725). *Walker, J.*, The Boiling Points of Homologous Compounds. II. (pp. 725-734). *Jackson, H.*, Observations on the Nature of Phosphorescence (pp. 734-744).

Vol. xiii. No. 6. *Journal of the Society of Chemical Industry.* (30th June, 1894.)

Guttmann, O., The Manufacture of Smokeless Powder (pp. 575-584). *McMillan, W. G.*, An Account of some Experiments on the Strength of Leather (pp. 585-593). *McMillan, W. G.*, Note on the Colour of Brass (pp. 593-595). *Dvorkovitz, P.*, The Distillation of Peat (pp. 596-607). *Naylor, W.*, Comparative Results of some Modern Systems of Sewage Treatment (pp. 608-610). *Bedson, P. P.*, Note on the Poisonous Action of Lead Salts (pp. 610-611). *Mackenzie, W. C.*, Nitrate of Soda in Egypt (pp. 611-613). *Smith, R. G.*, An Abnormal Milk (pp. 613-614). *Schweitzer, H.*, and *Lungwitz, E.*, On Commercial Analysis of Lard (pp. 614-616). *Lewkowitsch, J.*, Analysis of Fats. IV. Colour Reactions (pp. 617-621).

Vol. xxxviii. No. 231. *Philosophical Magazine and Journal of Science.* (Aug., 1894.)

Sutherland, W., The Attraction of Unlike Molecules. II. The Surface Tension of Mixed Liquids (pp. 188-197). *Ramsay, W.*, The Passage of Hydrogen through a Palladium Septum and the Pressure which it produces (pp. 206-218).

[[1] It is proposed to continue this list for each month.—Ed.]

Tome ii. *Annales de Chimie et de Physique.* (Août, 1894.)

Pigeon, L., Recherches chimiques et calorimetriques sur quelques combinaisons haloïdes du platine (pp. 433-502). *Étard*, Recherches expérimentales sur les solutions saturées. I. et II. (pp. 503-574).

Tomes xi.-xii. No. 13. *Bulletin de la Société Chimique de Paris.* (5th July, 1894.)

Aubin, E., Nouveaux fourneaux à mouffles (pp. 596-597). *Adam, P.*, Sur les émétiques (pp. 597-602). *Béhal, A.*, et *Choay, E.*, Sur les points de fusion et d'ébullition de quelques phénols et de leurs éthers benzoïques (pp. 602-604). *Klobb, T.*, Combinaisons de la pyridine avec les permanganates (pp. 604-610). *Guerbet*, Sur quelques dérivés de l'acide campholique (pp. 610-619). *Arth, G.*, Quelques expériences sur des houilles immergées dans l'eau (pp. 619-623). *Vaudin, L.*, Sur la composition chimique du colostrum de la vache (pp. 623-625). *Lunge, G.*, Volumètre à gaz universel (pp. 625-650). *Lambert, A. A.*, La désinfection par l'électricité, étude sur le procédé Hermite (pp. 650-667).

Tomes xi.-xii. No. 14. (20th July, 1894.)

Sabatier, P., Sur le bromure cuivrique: hydrate, solutions, bromhydrate, sels doubles (pp. 676-683). *Sabatier, P.*, Sur une réaction très sensible des composés cuivriques (pp. 683-685). *Brochet, A.*, Action du chlore à froid sur l'alcool isobutylique (4) (pp. 685-691). *Villiers, A.*, et *Fayolle*, Sur une réaction des aldéhydes. Différenciation des aldoses et des cétoses (pp. 691-693). *Causse, H.*, Synthèse de l'acide mésoxalique, et mésoxalate de bismuth (pp. 693-698). *Béhal, A.*, et *Choay, E.*, Recherche qualitative des phénols contenus dans la créosote officinale, créosote de hêtre et créosote de chêne (pp. 698-705). *Barral, E.*, Formation de quinone tétrachlorée au moyen de l'hexachlorophénol (pp. 705-710). *Combes, A.*, Synthèse de dérivés hexaméthyléniques, triéthylcyclohexanetrione (pp. 710-717). *Bertrand, G.*, Recherches sur le latex de l'arbre à laque du Tonkin (pp. 717-721). *Villiers, A.*, et *Fayolle*, Recherche des traces de chlore (pp. 721-723). *Scheurer-Kestner*, Observations à propos d'un travail de M. Lewes, sur une cause de perte de chaleur dans les chaudières (pp. 723-728). *De Boissieu, P.*, Perfectionnements dans l'industrie de l'acide sulfurique (pp. 728-729).

Tome cxix. No. 1. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (2nd July, 1894.)

Berthelot, Recherches sur la phenylhydrazine. Action de l'oxygène et action de l'eau; formation des sels (pp. 5-12). *Moissan, H.*, Impuretés de l'aluminium industriel (pp. 12-16). *Moissan, H.*, Préparation d'un carbure d'aluminium cristallisé (pp. 16-20). *Gernez, D.*, Recherches sur l'action qu'exercent les molybdates acides de soude et d'ammoniaque sur le pouvoir rotatoire de la rhamnose (isodulate) (pp. 63-65). *Colson, A.*, Sur le changement de signe du pouvoir rotatoire (pp. 65-68). *De Gramont, A.*, Sur le spectre de lignes du soufre, et sur sa recherche dans les composés métalliques (pp. 68-71). *Rousseau, G.*, et *Allaire, H.*, Nouvelles recherches sur les boracites bromées (pp. 71-73). *Pélabon, H.*, Influence de la pression sur la combinaison de l'hydrogène et du sélénium (pp. 73-75). *Villiers, A.*, et *Foyalle*, Sur une réaction des aldéhydes. Différenciation des aldoses et des cétoses (pp. 75-78). *Matignon, C.*, Sur les substitutions de radicaux alcooliques liés au carbone et à l'ajote (pp. 78-79). *Tanret*, Sur la picéine, glucoside des feuilles de sapin épicéa (pinus picea) (pp. 80-83). *De Saint-Martin, L.*, Sur la présence de l'hydrogène et de l'hydrogène protocarboné dans l'ajote résidual du sang (pp. 83-85). *Bouchardat, G.*, et *Lafont, J.*, Action de l'acide sulfurique sur le camphène (pp. 85-87). *Besson, A.*, Sur les dérivés bromés de l'éthylène perchloré (pp. 87-90). *Périer, G.*, Sur de nouvelles combinaisons organo-métalliques (pp. 90-92). *Effront, J.*, Sur la formation de l'acide succinique et de la glycérine dans la fermentation alcoolique (pp. 92-93). *Croctretelle, J.*, et *Dumont, J.*, De l'influence des chlorures sur la nitrification (pp. 93-96).

Tome cxix. No. 2. (9th July, 1894.)

Haller, A., et *Guyot, A.*, Sur de nouveaux dérivés obtenus en partant de l'acide benzoylbenzöique (pp. 139-143). *Charpy, G.*, Sur la relation entre la densité d'une solution saline et le poids moléculaire du sel dissous (pp. 156-158). *Tanret*, Sur une nouvelle

glucosane, la lévoglucosane (pp. 158-161). *Klobb, T.*, Synthèses au moyen de l'éther cyanacétique. Éthers phénylacylacyanacétiques (pp. 161-162). *Locher, J.*, Sur l'éther paraphtalodicyanacétique (pp. 162-165). *Renard, A.*, Sur le goudron de pin (pp. 165-166). *Béhal, A.*, et *Choay, E.*, Composition quantitative des créosotes de bois de hêtre et de bois de chêne (pp. 166-169). *Effront, J.*, Accoutumance des ferments aux antiseptiques et influence de cette accoutumance sur leur travail chimique (pp. 169-172).

Tome cxix. No. 3. (16th July, 1894.)

Moissan, H., Nouvelles recherches sur le chrome (pp. 185-191). *Haller, A.*, et *Guyot, A.*, Sur les acides diméthyl et diéthylamidobenzoylbenzoïques et la diméthylanilinephtaleine (pp. 205-208). *Le Bel, A.*, Sur les pouvoirs rotatoires variables avec la température (pp. 226-228). *Causse, H.*, Synthèse de l'acide mésoxalique et mésoxalate de bismuth (pp. 228-231). *Fleurent, E.*, Contribution a l'étude de quelques acides amidés, obtenus par dédoublement des matières protéiques végétales (pp. 231-233). *Chancel, F.*, Sur quelques dérivés des propylamines (pp. 233-235).

Tome cxix. No. 4. (23rd July, 1894.)

Friedel, C., Sur une nouvelle série de sulfophosphures, les thiohypophosphates (pp. 260-264). *Chassy, A.*, Sur l'electrolyse du sulfate de cuivre (pp. 271-272). *Chatelier, H. le*, Sur l'acier manganèse (pp. 272-274). *Locher*, Sur l'ether metaphtalodicyanacetique (pp. 274-276). *Pérrier, G.*, Combinaisons organo-métalliques du bornéol, du camphre et du camphre monochloré, avec le chlorure d'aluminium (pp. 276-277). *Guerbet*, Sur un acide nouveau, l'acide isocampholique (pp. 278-280). *Barral, Et.*, Action du pentachlorure de phosphure sur la quinone tétrachlorée (pp. 280-281).

Tome xxx. No. 2. *Journal de Pharmacie et de Chimie.* (15th July, 1894.)

Marty, Sur les injections hypodermiques de quinine (pp. 49-52). *Vial, F.*, Sur le bromhydrate d'isobutylcinchonine (pp. 52-55). *Villiers, A.*, et *Fayolle*, Recherche des traces de chlore (pp. 55-57). *Burcker, E.*, Note relative à la stabilité des dissolutions aqueuses de bichlorure de mercure (pp. 57-60). *Grimbert, L.*, Sur la sterilisation de l'eau (p. 60). *Tanret*, Sur la picéine, glucoside des feuilles du Sapin épicéa (Pinus Picea) (pp. 61-65).

Tome xxvi. No. 4. *Journal de la société physico-chimique russe.* (June, 1894.)

Potilitzine, A., Sur la solubilité de sulfate de calcium anhydre (pp. 170-179). *Bischoff, M. C.* et *Walgen, P.*, Recherches sur les dérivés des α-oxyacides mono- et bisubstitués (pp. 179-193). *Panormoff, A.*, Sur la determination du pouvoir rotatoire d'aprés la méthode du prof. Kanonnikoff (pp. 193-197). *Markownicoff, M. W.*, et *Reformatsky, A.*, Sur l'huille de roses de Bulgarie (pp. 197-202). *Konovaloff, M.*, Sur l'isomérisation des hydrocarbures aromatiques obtenus d'après la méthode de M. Friedel (pp. 202-206). *Schöne, E.*, Sur la presence du peroxyde d'hydrogène dans l'air atmosphérique (pp. 206-209). *Bohorodsky*, Sur les bromure et chlorure de lithium trihydratés (pp. 209-216). *Bohorodsky, A.*, Sur le sel double de l'iodure de plomb pentahydraté (pp. 216-220).

Band cclxxix. Heft 3. *Justus Liebig's Annalen der Chemie.* (3rd July, 1894.)

Graebe, C., und *Rateanu, A. Sc.*, Ueber Umwandlung von Fluoren in o-Aminobiphenyl (pp. 257-268). *Graebe, C.*, Ueber Methylacridone und Methylacridine (pp. 268-270). *Kahn, S.*, Ueber 2-Methylacridon und 2-Methylacridin (pp. 270-275). *Locher, J.*, Ueber 4-Methylacridon und 4-Methylacridin (pp. 275-281). *Kaufmann, V.*, Ueber 2, 4-Dimethylacridon und 2, 4-Dimethylacridin (pp. 281-288). *Fritsch, P.*, Ueber die chlorirung des Alkohols (pp. 288-301). *Fritsch, P.*, und *Schumacher, W.*, Ueber die chlorirung des Aethers (pp. 301-310). *Fritsch*, P., Ueber die chlorirung des Acetons (pp. 310-319) *Fritsch, P.*, Ueber die Darstellung von Diphenylacetaldehyd und eine neue Synthese von Tolanderivaten (pp. 319-324). *Buttenberg, W. P.*, Condensation des Dichloracetals mit Phenol und Toluol (pp. 324-337). *Wiechell, H.*, Condensation des Dichloracetals mit Anisol und Phenetol (pp. 337-344). *Ladenburg, A.*, *Mugdan, M.*, und *Brzostovicz, O.*, Ueber die Constitution des Dimethylpiperidins und seiner Homologen (pp. 344-366). *Wallach, O.*, und *Schrader, H.*, Ueber Verbindungen der Carvonreihe (pp. 366-391). *Wallach, O.*, und *Tuttle, F. E.*, Zur Charakteristik der Sesquiterpene (pp. 391-397).

Band cclxxx. Heft 1. (14th July, 1894.)

Offermann, H. von, Zur Geschichte des Anthracens (pp. 1-35). *Rugheimer, L. von*, Synthese von Pyridinderivaten aus Aldehyden und Benzoylpiperidin (pp. 35-88). *Einhorn, A. von*, und *Willstätter, R.*, Ueber die Dehydrogenisation hydrirer Benzoylcarbonsäuren (pp. 89-95). *Einhorn, A. von*, und *Willstätter, R.*, Ueber die p-Methylendihydrobenzoësäure (pp. 96-159). *Einhorn, A. von*, und *Willstätter, R.*, Ueber einige Verbindungen der Reihe hydrirter p-Toluylsäuren (pp. 159-165).

Band lii. Heft 4. *Annalen der Physik und Chemie* (*Wiedemann*). (15th June, 1894.)

Bock, A., Ueber das Verhältniss der Quercontraction zur Längendilation bei Stäben von verschiedenen Metallen als Function der Temperatur (pp. 609-621). *Haas, R.*, Der specifische Leitungswiderstand und der Temperaturcoefficient der Kupfer-Zinklegirungen (pp. 673-691). *Koch, K. R.*, und *Wüllner, A.*, Ueber Ausbreitungswiderstand und Polarisation an Electroden von kleiner Oberfläche (pp. 691-700). *Stankewitsch, B. W.*, Experimentelle Beiträge zur Kenntniss der dielectrischen Polarisation von Flüssigkeiten (pp. 700-728). *Hasselberg, B.*, Ueber das Linienspectrum des Sauerstoffs (pp. 758-762). *Wiesengrund, B.*, Ueber die Vorgänge bei Umschmelzungen von Blei-Zinn-Legirungen (pp. 777-792).

Jahrgang xxvii. No. 12. *Berichte der Deutschen Chemischen Gesellschaft.* (9th July, 1894.)

Pawlewski, B., Zur Reduction des Paradinitrodiazoamidobenzols (pp. 1565-1569). *Hill, H. B.*, und *Sawyer, H. E.*, Dehydroschleimsäure aus δ-Methylbrenzschleimsäure (pp. 1569-1571). *Carlson, M.*, Säuren aus dem Dicyanhydrin des Benzoylacetons (pp. 1571-1574). *Massot, W.*, Condensation von Methyl-Aethyl-Keton mit Malonsäure (pp. 1574-1578). *Kitzing, J.*, Neue Darstellungsweise der α_1. α_2-Dimethyladipinsäuren (pp. 1578-1580). *Meyer, Victor*, und *Sudborough, J. J.*, Das Gesetz der Esterbildung aromatischer Säuren (pp. 1580-1592). *Hartmann, C.*, und *Meyer, V.*, Ueber die Jodoniumbasen (pp. 1592-1600). *Hartmann, C.*, und *Meyer, V.*, Ueber die Darstellung der Jodobenzoësäure (p. 1600). *Meyer, V.*, Notijen über Aethylnitrolsäure und Nitromethan (pp. 1600-1602). *Göttig, C.*, Ueber die Bildung von Chlorhydrinestern im Allgemeinen und einen neuen Dichlorhydrinester der Anissäure (pp. 1602-1604). *Vorländer, D.*, Anilin und Isodibrombernsteinsäureester (pp. 1604-1606). *Baur, A.*, Ueber die Nebenproducte, welche bei der Darstellung des Butyltoluols auftreten (pp. 1606-1610). *Baur, A.*, Ueber die Nitroproducte des Butylbenzols (pp. 1610-1611). *Baur, A.*, Ueber das Aethylbutylbenzol (pp. 1611-1614). *Baur, A.*, Ueber die Phenole des Butyltoluols und dessen Aether (pp. 1614-1619). *Baur, A.*, Beiträge zur Kenntniss des bromirten Butyltoluols (pp. 1619-1623). *Baur, A.*, Ueber das Butylnaphtalin (pp. 1623-1624). *Schmidt, F. W.*, Ueber die quantitative Bestimmung des Nickels vermittelst ammoniakalischem Quecksilbercyanid (pp. 1624-1627). *Ciamician, G.*, und *Silber, P.*, Ueber das Maclurin und Phloretin (pp. 1627-1633). *Krüger, M.*, Ueber die Bestimmung des Stickstoffs in Nitraten, Nitro- und Nitroso-verbindungen auf nassem Wege (pp. 1633-1635). *Lepsius, B.*, Zur Esterbildung aromatischer Säuren (pp. 1635-1636). *Wagner, G.*, Zur Oxydation cyclisher Verbindungen (pp. 1636-1654). *Werner, A.*, Ueber Dinitrophenyläther von Oximen (pp. 1654-1658). *Ruhemann, S.*, Ueber die Isopyrazolone (pp. 1658-1663). *Jaffé, M.*, und *Kühn, B.*, Einwirkung von Thiophosgen auf Aethylendiamin (pp. 1663-1667). *Lomnitz, E.*, Ueber das Trimethyltrimethylenetrisulfon (pp. 1667-1679). *Pechmann, H. v.*, Studien über gemischte Formazylverbindungen (pp. 1679-1693). *Pechmann, H. v.*, und *Runge, P.*, Ueber Spaltungsproducte der Formazylverbindungen (pp. 1693-1699). *Pechmann, H. v.*, Ueber Eigenschaften und Spaltung isomerer Amidine (pp. 1699-1702). *Hantzsch, A.*, Ueber stereoisomerie bei Diazoverbindungen und die Natur der "Isodiazokörper" (pp. 1702-1726). *Hantzsch, A.*, Ueber stereoisomere Salze der Benzoldiazosulfonsäure (pp. 1726-1729). *Hantzsch, A.*, Zur Constitution der Diazobenzolsäure (pp. 1729-1732). *Maull, C.*, Ueber ein neues Schüttelwerk (pp. 1732-1733). *Auwers, K.*, und *Beger, C.*, Anwendung der Friedel-Crafts 'schen Reaction auf Thiophenoläther (pp. 1733-1741). *Auwers, K.*, und *Bredt, T. V.*, Ueber Dithienyle (pp. 1741-1747). *Krafft, F.*, und *Stern, A.*, Ueber das Verhalten der fettsauren Alkalien und der Seifen in Gegenwart von Wasser. I. (pp. 1747-1755). II. (pp. 1755-1761). *Krafft, F.*, und *Lyons, R. E.*, Ueber Diphenylselenid und

einige Derivative desselben (pp. 1761-1768). *Krafft, F.*, und *Lyons, R. E.*, Ueber Diphenyltellurid und ein Verfahren zur Darstellung von Sulfiden, Seleniden, und Telluriden (pp. 1768-1774). *Freund, M.*, Ueber Dithiourazol und Derivative desselben (pp. 1774-1775). *Engler, C.*, und *Bauer, F. W.*, Die Reductionsproducte des α-Methylpyridylketons und die Nichtidentität des α-Aethyl-Piperylalkins mit dem activen Pseudoconhydrin (pp. 1775-1779). *Engler, C.*, und *Kronstein, A.*, Ueber Conhydrin und Pseudoconhydrin (pp. 1779-1784). *Engler, C.*, Zur Kenntniss der Ester und Amide der Pyridincarbonsäuren (pp. 1784-1790). *Willgerodt, C.*, Ueber Jodoso- und Jodoverbindungen des p-Dijodbenzols (pp. 1790-1794).

Jahrgang xxvii. No. 13. (23rd July, 1894.)

Paal, C., und *Senninger, H.*, Ueber die Einwirkung von Ammoniak und primären Aminen auf o-Oxybenzylalkohol (Saligenin) (pp. 1799-1804). *Eberhardt, C.*, und *Welter, Ad.*, Ueber einige Condensationsproducte aromatischer Amine mit Formaldehyd in alkalischer Lösung (pp. 1804-1815). *Wohl, A.*, Notiz zum technischen Verfahren der Anilindarstellung (pp. 1815-1818). *Manasse, O.*, und *Rupe, H.*, Ueber die Oxydation des Menthons (pp. 1818-1823). *Krafft, F.*, Ueber eine einfache Regulirungsvorrichtung zur Herstellung beliebiger Minderdrucke (pp. 1823-1824). *Göttig, C.*, Ueber ein neues Verfahren zur Erzeugung von Metallniederschlägen, welches sich besonders zur metallischen Ueberziehung des Aluminiums eignet (pp. 1824-1826). *Willgerodt, C.*, Ueber die Wandelbarkeit von Jodosoverbindungen bei gewöhnlicher Temperatur (pp. 1826-1827). *Paal, C.*, Ueber die Peptonsalze des Eieralbumins (pp. 1827-1851). *Lossen W.*, und *Gerlach, O.*, Ueber die Brommesaconsäure (pp. 1851-1857). *Hantzsch, A.*, Ueber stereoisomere Diazoamidoverbindungen (pp. 1857-1866). *Paal, C.*, und *Commerell, O.*, Ueber das Thiocumazon und seine Umwandlung in Thiochinazoline (pp. 1866-1870). *Ehrlich, Paul*, und *Einhorn, A.*, Ueber die physiologische Werkung der Verbindungen der Cocaïnreihe (pp. 1870-1874). *Einhorn, A.*, und *His, H.*, Ueber einige in der Benzoyl-gruppe substituirte Cocaïne (pp. 1874-1880). *Einhorn, A.*, und *Faust, E. S.*, Ueber Rechtscocaïne, welche in der Benzoylgruppe substituirt sind (pp. 1880-1888). *Pechmann, H. v.*, Ueber Diazomethan (pp. 1888-1892). *Schulz, M.*, und *Tollens, B.*, Ueber Verbindungen des Formaldehydes mit mehrwerthigen Alkoholen (Mannit, etc.) (pp. 1892-1894). *Kahlbaum, G. W. A.*, und *Wirkner, C. G. v.*, Zur Prüfung von Hen. Dühring's Gesetz der correspondirenden Siedetemperaturen (pp. 1894-1903). *Willgerodt, C.*, Ueber Jodoso- und Jodopseudocumol (pp. 1903-1905). *Küster, F. W.*, Zur jodometrischen Bestimmung von β-Napholt (pp. 1905-1909). *Thiele, J.*, und *Lachmann, A.*, Ueber das Nitramid (pp. 1909-1911). *Kosmann, B.*, Ueber die Bindung des Wassers in anorganischen Salzen (pp. 1911-1912). *Baeyer, A.*, und *Manasse, O.*, Ueber die Einwirkung von Nitrosochlorid auf Menthon (pp. 1912-1915). *Baeyer, A.*, und *Manasse, O.*, Ortsbestimmungen in der Terpenreihe (pp. 1915-1923). *Philips, A.*, Ueber Anthrapyridinchinon (pp. 1923-1927). *Gattermann, L.*, Ueber die elektrolytische Reduction aromatischer Nitrokörper (pp. 1927-1942). *Gattermann, L.*, und *Friedrichs, F.*, Ueber die Einwirkung des elektrischen Stromes auf Benzol (pp. 1942-1943). *Gattermann, L.*, und *Weinlig, K.*, Zur Kenntniss der Siliciumverbindungen (pp. 1943-1948). *Bamberger, E.*, Zur Kenntniss des Diazotirungsprocesses (pp. 1948-1954). *Bamberger, E.*, und *Goldschmidt, C.*, Ueber eine eigenthümliche Synthese des Isochinolins (pp. 1954-1957). *Beckmann, E.*, Ueber die Reaction zwischen N-Aldoximäthern und Phenylisocyanat (pp. 1957-1959). *Erlenmeyer, E.*, Benzoylsuperoxyd ein Oxydationsproduct des Bittermandelöls (pp. 1959-1962). *Widman, O.*, Ueber die Einwirkung des Cyans auf α-Acidylphenylhydrazide (pp. 1962-1969). *Nencki, M.*, Synthesen hydroxylirter aromatischer Basen (pp. 1969-1979). *Dzierzgowski, S.*, Ueber die Condensationsproducte von Salicyl- und Para-Oxybenzaldehyd mit Chinaldin (pp. 1979-1983). *Dzierzgowski, S.*, Zur Kenntniss der aus Phenolen und halogensubstituerten Fettsäuren erhaltenen Ester und Ketone (pp. 1983-1989). *Kostanecki, H. v.*, Ueber die Constitution des Euxanthons (pp. 1989-1994). *König, E.*, und *Kostanecki, S. v.*, Ueber einige Derivate der Oxyxanthone und über das Maklurin (pp. 1994-1997). *Komarowsky, A.*, und *Kostanecki, S. v.*, Ueber das Benzoresorcin (pp. 1997-2001). *Aschan, O.*, Ueber die isomeren Camphersäuren (pp. 2001-2012). *Töhl, A.*, und *Framm, F.*, Ueber das Sulfopiperidid und die durch Oxydation desselben entstehende Sulfo-δ-amidovaleriansäure (pp. 2012-2016). *Stoermer, R.*, und *Burkert, O.*, Ueber das Piperi-

doacetal (pp. 2016-2018). *Wolff, L.*, Antwort an C. Stoehr (pp. 2018-2020). *Doebner, O.*, Ueber die Synthese der α-Alkyl-β-naphtocinchoninsäuren, eine specifische Reaction auf Aldehyde (pp. 2020-2031). *Fischer, E.*, und *Thierfelder, H.*, Verhalten der verschiedenen Zucker gegen reine Hefen (pp. 2031-2037). *Liebermann, C.*, Weitere Untersuchungen über die Allozimmtsäure (pp. 2037-2051). *Liebermann, C.*, Zur Abhandlung von Einhorn und Willstätter über die technische Darstellung von Cocaïn aus seinen Nebenalkaloïden (pp. 2051-2053). *Vorländer, D.*, Ueber die Einwirkung von Malonester auf Benzylidenaceton (pp. 2053-2058).

Band l. Nos. 13, 14. *Journal für praktische Chemie.* (9th July, 1894.)

Bechert, C., Ueber die Condensation von Aldehyden und Cyaniden (pp. 1-29). *Claus, A.*, und *Ammelburg, A.*, Meta-ana-Dibromchinolin IV. m-ana-γ-Tribromchinolin und V. o-m-ana-Tribromchinolin (pp. 29-38). *Cohn, G.*, Regelmässigkeiten von Siede- und Schmelzpunkten (pp. 38-58). *Vaubel, W.*, Der Benzolkern. II. (pp. 58-61). *Lebedeff, J.*, Umwandlung der Elaïdinsäure in Isoöl- und Oelsäure (pp. 61-65). *Saytzeff, N.*, Umwandlung der Brassidinsäure in Isoeruca- und Erucasäure (pp. 65-68). *Joukowsky, M.*, Oxydation der Brassidinsäure mit Kaliumpermanganat in alkalischer Lösung (pp. 68-71). *Talanzeff, S.*, Zur Geschichte der Behensäure (pp. 71-73). *Saytzeff, M. C.* und *A.*, Ueber die Einwirkung von Natriumbisulfit und schwefliger Säure auf Oel- und Erucasäure (pp. 73-81). *Saytzeff, A.*, Zur Frage nach der Constitution der Oelsäure, Erucasäure und der mit ihnen isomeren Säuren (pp. 81-87). *Schall, C.*, Zur Dampfdichtebestimmung und über ein Verfahren ohne Luft- oder Wasserluftpumpe zu evacuiren (pp. 87-89). *Deninger, A.*, Ueber o-Oxydiphenylamin (pp. 89-91). *Walther, R.*, Ueber synthetische Versuche mittelst Natrium und Nitrilen (pp. 91-93). *Herfeldt, G.*, Zur Kenntniss des chlorchromsauren Kaliums (pp. 93-95). *Marchlewski, S.*, Zur Constitution der Anilinverbindung der Glukose (pp. 95-96).

Band xv. Heft 4 und 5. *Monatshefte für Chemie und verwandte Thiele anderer Wissenschaften.* (30th June, 1894.)

Heinisch, W., Ueber einige Derivate der Veratrumsäure und des Veratrols (pp. 229-235). *Heinisch, W.*, Ueber die trockene Destillation des Kalksalzes der Diäthylprotocatechusäure (pp. 235-239). *Wechsler, A.*, Zur Kenntniss des Resacetophenons (pp. 239-249). *Valenta, E.*, Ueber die Löslichkeit des Chlor- Brom- und Jodsilbers in verschiedenen anorganischen und organischen Lösungsmitteln (pp. 249-254). *Jäger, G.*, Ueber die innere Reibung der Lösungen (pp. 254-269). *Stengel, A.*, Krystallform des Tetramethylbrasilins (pp. 269-273). *Margulies, R.*, Ueber die Oxydation normaler fetter Säuren (pp. 273-276). *Kulisch, V.*, Ueber eine Synthese von Chinolin (pp. 276-280). *Vortmann G.*, Elektrolytische Bestimmung der Halogene (pp. 280-285). *Streintz, F.*, Ueber die thermochemischen Vorgänge im Secundär-Elemente (pp. 285-295). *Arnstein, H.*, Notiz über das Verhalten des trimethylgallussauren Calciums bei der trockenen Destillation (pp. 295-299). *Pomeranz, C.*, Synthese des Isochinolins und seiner Derivate. I. (pp. 299-307). *Mangold, C.*, Einige Beiträge zur Kenntniss der Ricinusöl-, Ricinelaïden- und Ricinstearolsaure (pp. 307-316). *Goldschmiedt, G.*, und *Hemmelmayr, F. v.*, Ueber das Scoparin. II. (pp. 316-362). *Mauthner, J.*, und *Suida, W.*, Beiträge zur Kenntniss des Cholesterins. II. (pp. 362-374).

Vol. iii. Fascicolo 11. *Atti della Reale Accademia dei Lincei.* (2 Guigno, 1894.)

Daccomo, G., Sulla funzione chimica dell'acido filicico (pp. 555-562).

L'Orosi. (Guigno, 1894.)

Schiff, U., ed *Ostrogovich, A.*, Reazioni varie della Ortotolidina (pp. 181-184). *Pellizzari, G.*, Guanazolo e suoi derivati alchilici (pp. 185-192).

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN AUGUST, 1894.[1]

Vol. xviii. No. 284. *American Journal of Science.* (August, 1894.)

Pratt, J. H., Determination of Ferrous Iron in Silicates (pp. 149-151). *Roberts, C. F.*, Action of Reducing Agents on Iodic Acid (pp. 151-159). *Gooch, F. A.*, and *Kreider, D. A.*, The Generation of Chlorine for Laboratory Purposes (pp. 166-175).

Vol. xvi. No. 8. *The Journal of the American Chemical Society.* (August, 1894.)

Dewey, F. P., The Accuracy of the Commercial Assay for Silver (pp. 505-519). *Trevor, J. E.*, The Achievements and Aims of Physical Chemistry (pp. 519-524). *Osborne, T. B.*, and *Voorhees, C. L.*, Proteids of the Wheat Kernel (pp. 524-535). *Bush, C. S.*, Degras (pp. 535-538). *Mason, W. P.*, The Boric Acid Works at Lardarelo (pp. 538-541). *Richards, J. W.*, The Commercial Valuation of Lead-tin and Lead-antimony Alloys (pp. 541-543). *Field, W. D.*, Pyroxylin : Its Manufacture and Applications (pp. 543-549). *Ross, B. B.*, Recent Work on the Sugars (pp. 549-553). *Noyes, W. A.*, and *Frohman, E. D.*, The Volumetric Determination of Phosphorus in Steel (pp. 553-559). *Crossman, T.*, The Analysis of Malt (pp. 559-565). *Bradbury, R. H.*, On the Reaction between Molybdic Acid and Potassium Chromate and Bichromate (pp. 565-569). *Smith, E. F.*, and *Shinn, O. L.*, Action of Molybdenum Dioxide upon Silver Salts (pp. 569-571).

Vol. xix. No. 221. *The Analyst.* (August, 1894.)

Budden, E. R., and *Hardy, H.*, The Colorimetric Estimation of Minute Quantities of Lead, Copper, Tin and Iron (pp. 169-178). *Allen, A. H.*, The Examination of Urine for Small Quantities of Sugar (pp. 178-188).

Vol. lxx. No. 1810. *Chemical News and Journal of Physical Science.* (3rd August, 1894.)

Tatlock, R. R., Heating Power of Smoke (p. 37). *Linebarger, C. E.*, The Boiling Points of Dilute Solutions of Water in Alcohol and Ether (pp. 52-53). *Burgess, W. F.*, Apparatus for Collecting Samples of Water some Distance beneath the Surface (p. 54).

Vol. lxx. No. 1812. (17th August, 1894.)

Cain, J. C., The Action of Chlorine on Phosphonium Iodide (pp. 80-81). *Frankforter, G. B.*, The Mississippi River Water (p. 81). *Crookes, W.*, The Separation of the Rare Earths (pp. 81-82).

Vol. lxv. No. 381. *Journal of the Chemical Society.* (August, 1894.)

Dougal, M. D., A Specimen of Early Scottish Iron (pp. 744-750). *Frankland, P.*, and *MacGregor, J.*, The Maximum Molecular Deviation in the Series of the Ethereal Salts of Active Diacetylglyceric Acid (pp. 750-760). *Frankland, P.*, and *MacGregor, J.*, Observations on the Influence of Temperature on the Optical Activity of Organic Liquids (pp. 760-772). *Thorpe, T. E.*, The Mineral Waters of Cheltenham (pp. 772-782). *Thorpe, T. E.*, and *Rodger, J. W.*, The Supposed Relation between the Solubility of a Gas and the Viscosity of its Solvent (pp. 782-788). *Arnold, J. O.*, and *Read, A. A.*, The Chemical Relations of Carbon and Iron (pp. 788-802). *Cook, E. H.*, Effects of Heat on Iodates and Bromates. I. Potassic Iodate and Bromate (pp. 802-815). *Perkin, W. H.*, The Magnetic Rotation of Compounds supposed to contain Acetyl, or to be of Ketonic Origin. II. (pp. 815-828).

Vol. lxv. No. 382. (September, 1894.)

Sell, W. J., and *Easterfield, T. H.*, Studies on Citrazinic Acid. Part III. (pp. 828-834). *Meldola, R.*, and *Hanes, E. S.*, Azo-compounds of the Ortho-series (pp. 834-842). *Perkin, A. G.*, and *Cope, F.*, Derivatives of Anthraquinone. Part III. (pp. 842-851).

[[1] It is proposed to continue this list for each month.—Ed.]

Vol. lvi. No 336. *Proceedings of the Royal Society.* (1st September, 1894.)

Clowes, F., The Composition of Atmospheres which Extinguish Flame (pp. 2-7). *Macnab, W.*, and *Ristori, E.*, Researches on Modern Explosives (pp. 8-19). *Threlfall, R.*, *Brearley, J. H. D.*, and *Allen, J. B.*, The Electrical Properties of Pure Sulphur (pp. 32-40).

Vol. xxxviii. No. 232. *Philosophical Magazine and Journal of Science.* (Sept., 1894.)

Moore, B., On a Relation between the Surface-tension and Osmotic Pressure of Solutions (pp. 279-285). *Baby, E. C. C.*, and *Ramsay, W.*, Experiments on the Relation of Pressure, Volume and Temperature of Rarefied Gases (pp. 301-327).

Tome iii. *Annales de Chimie et de Physique.* (September, 1894.)

Gasselin, V., Action du fluorure de bore sur quelques composés organiques (pp. 5-83). *Bagard, H.*, Sur les forces électromotrices thermoélectriques entre deux électrolytes et le transport électrique de la chaleur dans les électrolytes (pp. 83-138). *Berthelot*, Remarques sur les limites de l'electrolyse (pp. 138-144).

Tome xxviii. No. 7. *Bulletin de l'Académie Royale des Sciences de Belgique.* (August, 1894.)

Swarts, F., Sur l'acide dichlorfluoracétique (pp. 15-20). *Spring, W.*, Sur l'apparition dans l'état solide de certaines propriétés caractéristiques de l'état liquide on gazeux des métaux (pp. 23-46). *De Sonay, A.*, Sur les dérivés chlorés du méthylal (pp. 102-110).

Tomes xi.-xii. No. 15. *Bulletin de la Société Chimique de Paris.* (5th Août, 1894.)

Berthelot et *Matignon*, Sur la chaleur de combustion des principaux gaz hydrocarbonés (pp. 738-741). *Berthelot*, Sur une méthode destinée à étudier les échanges gazeux entre les êtres vivants et l'atmosphère qui les entoure (pp. 741-744). *Berthelot* et *Matignon*, Sur l'azoture de baryum (p. 744). *Berthelot* et *Vieille*, Sur quelques sels de l'acide azothydrique (pp. 744-748). *Berthelot*, Sur la sublimation des iodures rouge et jaune de mercure (pp. 748-749). *Trillat* et *Gambier*, Action du trioxyméthylène et du perchlorure de fer sur les alcools de la série grasse (pp. 749-752). *Trillat* et *Gambier*, Sur les éthers méthyléniques obtenus par l'action du trioxyméthylène et du perchlorure de fer sur les alcools (pp. 752-760). *Simon, L.*, Sur le pouvoir rotatoire du pyruvate et du lactate d'amyle (pp. 760-767). *Mouren, C.*, Action du chlorure de thionyle (ac. chlorosulfureux) sur les acides minéraux (pp. 767-770). *Schiff, H.*, Sur l'acide triacétylgallique (pp. 770-771). *Berthelot* et *André, G.*, Sur les matières organiques constitutives du sol végétal (pp. 771-781). *Berthelot*, Nouvelles recherches sur la fixation de l'azote atmosphèrique par les microorganismes (pp. 781-784). *Berthelot*, Nouvelles recherches sur les microorganismes du sol fixateurs de l'azote (pp. 784-793). *Berthelot* et *André, G.*, Etudes sur la formation de l'acide carbonique et l'absorption de l'oxygène par les feuilles détachées des plantes (pp. 793-810). *Berthelot*, Remarques sur l'echauffement et l'inflammation spontanée des foins (pp. 810-812).

Tome cxix. No. 5. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (30th July, 1894.)

Barbier, Ph., et *Bouveault, L.*, Sur la constitution du rhodinol de l'essence de Pelargonium (pp. 334-337). *Mouren, Ch.*, Action du chlorure de thionyle (acide chlorosulfureux) sur quelques composés minéraux et organiques (pp. 337-340). *Burcker, E.*, Sur la stabilité des solutions aqueuses de bichlorure de mercure (pp. 340-342). *Petit, P.*, L'oxydation des moûts de bière (pp. 342-344).

Tome cxix. No. 6. (6th Août, 1894.)

Villard, P., Sur l'hydrate carbonique et la composition des hydrates de gaz (pp. 368-371). *Tassilly*, Sels basiques de calcium (pp. 371-373).

Tome cxix. No. 7. (13th Août, 1894.)

Mathias, L., Sur la chaleur spécifique de l'acide sulfureux liquide (pp. 404-407). *Wunsch, A.*, Sur la benzoïlquinine (pp. 407-409).

Tome cxix. No. 8. (20th Août, 1894.)

Henry, L., Sur l'action des hydracides halogénés sur l'aldéhyde formique en présence des alcools (pp. 425-426). *Burcker, E.*, et *Stabil, C.*, Action de l'anhydride camphorique sur le benzène en présence du chlorure d'aluminium (pp. 426-428). *Marie, T.*, Sur l'extraction des acides libres de la cire d'Abeilles (pp. 428-431).

Tome xxx. No. 3. *Journal de Pharmacie et de Chimie.* (1st Août, 1894.)

Béhal, A., et *Choay, E.*, Recherche qualitative des phénols contenus dans la créosote officinale, créosote de hêtre et créosote de chêne (pp. 97-106). *Petit, A.*, et *Fèvre, A.*, Sur une combinaison de diméthylphénylpyrazolone et d'acide β- résorcylique (Résalgine) (pp. 106-108). *Tanret*, Sur une nouvelle glucosane, la lévoglucosane (pp. 108-111). *Vignon, L.*, Sur la conservation des solutions étendues de sublimé (pp. 111-114). *Villiers, A.*, et *Fayolle*, Sur la recherche de l'acide bromhydrique (pp. 114-117).

Tome xxx. No. 4. (15th Août, 1894.)

Villiers, A., et *Fayolle*, Sur le dosage de l'iode (pp. 145-148). *Adam, P.*, Sur les émétiques (pp. 148-151). *Turié, Fr.*, De la magnésie et des sulfates dans les vins récoltés sur les sables marins (pp. 151-154). *Béhal, A.*, et *Choay, E.*, Composition quantitative des créosotes de bois de hêtre et de bois de chêne (pp. 154-160).

Tome xxx. No. 5. (1st September, 1894.)

Petit, A., et *Polonovski*, Essai des glycérophosphates employés en thérapeutique (pp. 193-199). *Marie, T.*, Sur l'extraction des acides libres de la cire d'abeilles (pp. 199-202). *Carles, P.*, Les sous-nitrates de bismuth du commerce (pp. 202-207). *Denigès, G.*, Recherche rapide de l'étain (pp. 207-212).

Tome xxvi. No. 5. *Journal de la société physico-chimique russe.*

Potilitzine, A., Sur les causes et les conditions de la prise du gypse (pp. 221-229). *Kondakoff, I.*, Action des anhydrides acides sur les oléfines en présence du chlorure de zinc (pp. 229-234). *Panfiloff, I.*, Sur le bromure et l'iodure de magnésium decahydratés (pp. 234-239). *Volkmann, F.*, Sur les hydrates du bromure et de l'iodure du fer (pp. 239-250). *Rossolimo, A.*, Sur les condensation du caprylène par l'acide sulfurique (pp. 250-255). *Tanatar, S.*, Note concernant la théorie d'Arrhenius (pp. 255-263).

Tome xiii. No. 2. *Recueil des Travaux Chimiques des Pays Bas.* (Août, 1894.)

Hamburger, H. J., Sur la détermination de la tension osmotique de liquides albumineux au moyen de l'abaissement du point de congélation (pp. 67-80). *Holleman, A. F.*, Observations sur l'oxalène-diamidoxime (pp. 80-88). *Boot, J. C.*, Sur quelques améliorations apportées à l'appareil employé par M. Romyn pour le dosage de l'oxygène dans l'eau (pp. 88-93). *Hoogewerff, S.*, et *Dorp, van, W. A.*, Sur deux isoimides substituées de l'acide phtalique (pp. 93-101). *Lobry de Bruyn, C. A.*, Etude comparative des trois dinitrobenzènes (pp. 101-148). *Lobry de Bruyn, C. A.*, et *Leent, van, F. H.*, Sur le trinitrobenzène et le dinitrophénol symétriques (pp. 148-155). *Behrens, H.*, et *Linge, van, A. R.*, Sur l'acier cementé, le ferrochrome, le ferrotungstène, l'acier chromé et l'acier tungstaté (pp. 155-181).

Band cclxxxi. Heft 1. *Justus Liebig's Annalen der Chemie.* (13th Aug., 1894.)

Fettback, H., Ueber Carboxyl- und Hydroxyl-derivate der α-Phenylcinchoninsäure (pp. 1-15). *Ferber, E.*, Ueber Amidoderivate der α-Phenylcinchoninsäure (pp. 15-25). *Knoevenagel, E.*, 1, 5, Diketone (pp. 25-127). *Wallach, O.*, Zur Kenntniss der Terpene und der ätherischen Oele. XXX. (pp. 127-147). *Wallach, O.*, Zur Kenntniss der Terpene und der ätherischen Oele. XXXI. (pp. 147-166).

Band liii. Heft 1. *Annalen der Physik und Chemie (Wiedemann).* (15th July, 1894.)

Hallwachs, W., Ueber Lichtbrechung und Dichte verdünnter Lösungen (pp. 1-14). *Kohlrausch, F.*, und *Hallwachs, W.*, Ueber die Dichtigkeit verdünnter wässriger Lösungen (pp. 14-43).

Band liii. Heft 2. (10th August, 1894.)

Kohlrausch, F., und *Heydweiller, A.*, Ueber reines Wasser (pp. 209-236). *Paschen, F.*, Die genauen Wellenlängen der Banden des ultrarothen Kohlensäure- und Wasserspectrums (pp. 334-337). *Toepler, M.*, Bestimmung der Volumänderung beim schmelzen für eine Anzahl von Elementen (pp. 343-379). *Jones, H. C.*, Die Erniedrigung des Gefrierpunktes des Lösungsmittels durch Electrolyte (pp. 392-396).

Band l. Nos. 15, 16, 17. *Journal für praktische Chemie.* (9th August, 1894.)

Broche, C., Ueber Tribromacetonitril und einige Abkömmlinge des polymeren Trichloracetonitrils (pp. 97-119). *Brühl, J. W.*, Studien über Tautomerie (pp. 119-222). *Fileti, M.*, Ueber das Moleculargewicht des Quecksilberchlorürs (pp. 222-223). *Lederer, L.*, Eine neue Synthese von Phenolalkoholen (pp. 223-227). *Rothenburg, R. v.*, Pyrazolon und Isopyrazolon (pp. 227-231). *Rothenburg, R. v.*, Ueber Phenylisoxazolonimid (pp. 231-232). *Claus, Ad.*, und *Howitz, H.*, Ueber β-Bromchinolin und γ-Bromchinolin (pp. 232-239). *Claus, Ad.*, Ueber die beiden isomeren Firmen des Diazobenzolkaluimsulfits (pp. 239-240).

Band vii. Heft 1 und 2. *Zeitschrift für Anorganische Chemie.* (4th Aug., 1894.)

Brauner, B., Fluoplumbate und freies Fluor (pp. 1-13). *Gooch, F. A.*, und *Kreider, D. A.*, Nachweis von überchlorsauren Alkalien bei Gegenwart von Chloriden, Chloraten und Nitraten (pp. 13-17). *Gooch, F. A.*, und *Kreider, D. A.*, Darstellung von Chlor für Laboratoriumszwecke (pp. 17-22). *Penfield, S. L.*, Ueber einige Methoden zur Bestimmung des Wassergehaltes (pp. 22-33). *Sörensen, S. P. L.*, Kritische Präparatenstudien (pp. 33-41). *Smith, E. F.*, und *Hibbs, J. G.*, Ueber die Einwirkung von Salzsäuregas auf vanadinsaures Natron (pp. 41-43). *Bradbury, R. H.*, Ueber die Reaktion zwischen Molybdänsäure und einfach- und zweifach-chromsaurem Kalium (pp. 43-47). *Smith, E. F.*, und *Shinn, O. L.*, Ueber die Einwirkung von Molybdändioxyel auf Silbersalz (pp. 47-49). *Schöne, E.*, Ueber das atmosphärische Ozon (pp. 49-50). *Carey Lea, M.*, Ueber den Prioritätsanspruch von Prof. Spring (pp. 50-51). *Spring, W.*, Erwiderung auf vorhergehende Zeilen von M. Carey Lea (pp. 51-52). *Krüss, G.*, und *Thiele, E.*, Ueber den Lösungszustand des Jod und die wahrscheinliche Ursache der Farbenunterschiede seiner Lösungen (pp. 52-82). *Smith, E. F.*, und *Heyl, P.*, Ueber die Verwendung von Quecksilberoxyd bei der Analyse (pp. 82-91). *Schiff, H.*, Phosphorpentachlorid und Wolframtrioxyd (pp. 91-92). *Jannasch, P.*, und *Locke, J.*, Ueber einen fluorfreien Humit (pp. 92-96). *Smith, E. F.*, und *Maas, P.*, Versuche mit den Oxyden von Columbium und Tantal (pp. 96-99).

Band xiv. Heft 3. *Zeitschrift für Physikalische Chemie.* (24th July, 1894.)

Luggin, H., Ueber eine lichttempfindliche Elektrode (pp. 385-394). *Goldschmidt, H.*, und *St. Freund*, Ueber den Einfluss der Stellungsisomerie auf das Drehungsvermögen optisch aktiver Körper (pp. 394-409). *Ewan, T.*, Ueber den osmotischen Druck von Lösungen von endlicher Konzentration (pp. 409-424). *Löb, W.*, Ueber Molekulargewichtsbestimmung von in Wasser löslichen substanzen mittels der roten Blutkörperchen (pp. 424-433). *Tammann, G.*, Ueber den Einfluss des Drucks auf die Eigenschaften von Lösungen (pp. 433-446). *Bakker, G.*, Zur Theorie der Flüssigkeiten und Gase II. (pp. 446-456). *Bakker, G.*, Thermodynamische Ableitung der Zustandsgleichung von van der Waals für Flüssigkeiten und Gase (pp. 456-467). *Ruppin, E.*, Volumänderungen bei der Neutralisation starker Säuren und Basen (pp. 467-486). *Ramsay, W.*, Ueber den kritischen Zustand (pp. 486-491). *Von Recklinghausen, M.*, Methoden und Apparate zur Verfolgung von Gasrealktionen bei gewöhnlicher Temperatur durch Beobachtung der Volumänderungen (pp. 491-506). *Werner, A.*, und *Miolati, A.*, Beiträge zur Konstitution anorzanischer Verbindungen II. (pp. 506-522). *Rinne, F.*, Ueber Krystalltypen bei Metallen, ihren Oxyden, Sulfiden, Hydroxyden und Halogenverbindungen. Erwiderung auf eine Besprechung des Herrn Retgers (pp. 522-535). *Cohen, E.*, und *Bredig, G.*, Das Umwandlungselement und eine neue Art seiner Anwendung (pp. 535-548). *Van T Hoff, J. H.*, Historische Notiz (p. 548).

Band xiv. Heft 4. (7th August, 1894.)

Smale, F. J., Studien über Gasketten (pp. 577-622). *Nernst, W.*, Methode zur Bestimmung von Dielektrizitätskonstanten (pp. 622-664). *Bakker, G.*, Bemerkung über die Funktion

α in der Zustandsgleichung von van der Waals (pp. 664-671). *Bakker, G.*, Zusammenhang zwischen den Gesetzen von Mariotte, Gay-Lussac und Joule (pp. 671-673). *Fanjung, J.*, Ueber den Einfluss des Druckes auf die Leitfähigkeit von Elektrolyten (pp. 673-701). *Schall, C.*, Ueber die Abnahme der molekularen Leitfähigkeit einiger starken, organischen Säuren bei Ersatz des Lösungswassers durch Alkohole (pp. 701-711).

Band xix. Heft 6. *Zeitschrift für Physiologische Chemie.* (3rd August, 1894.)

Winterstein, E., Zur Kenntniss der in den Membranen der Pilze enthaltenen Bestandtheile I. (pp. 521-563). *Lassar-Cohn*, Die Säuren der menschlichen Galle (pp. 563-574). *Hoppe-Seyler, F.*, Apparat zur Messung der respiratorischen Aufnahme und Abgabe von Gasen am Menschen nach dem Principe von Regnault (pp. 574-590). *Laves, E.*, Respirationsversuche am gesunden Menschen (pp. 590-603). *Weintraud, W.*, und *Laves, E.*, Ueber den respiratorischen Stoffwechsel im Diabetes mellitus (pp. 603-629). *Weintraud, W.*, und *Laves, E.*, Ueber den respiratorischen Stoffwechsel eines diabetischen Hundes nach Pancreasexstirpation (pp. 629-647). *Mohr, P.*, Beiträge zur titrimetrischen Bestimmung der Magenacidität (pp. 647-650).

Vol. iii. (1). Fascicolo 12. *Atti della Reale Accademia dei Lincei.* (17th June, 1894.)

Ciamician e *Silber*, Sintesi dell'etere trimetilico della benzofloroglucina (metilidrocotoina o benzoilidrocotine) (pp. 574-579). *Angeli*, Sopra le sostanze che contengono gli anelli $C_n N_2 O_2$ (pp. 590-597). *Miolate* e *Longo*, Sulla stabilità delle immidi succiniche sostituite nell'azoto (pp. 597-605).

Vol. iii. (2). Fascicolo 1. (1st July, 1894.)

Carrara, Sulle Selenetine. Nuova serie di composto del Selenio (pp. 32-37). *Angeli* e *Malagnini*, Sopra la configurazione di alcune gliossime (pp. 37-43).

Vol. iii. (2). Fascicolo 2. (15th July, 1894.)

Pellizzari, Nuova sintesi del triazolo e dei suoi derivati (pp. 67-72). *Angeli*, Azione dell'acido nitroso sopra l'amminouracili e sopra l'amminoacetone (pp. 72-76).

Vol. iii. (2). Fascicolo 3. (5th August, 1894.)

Ciamician e *Boeris*, Sulla costituzione delle idrochinoline, considerazioni ed esperienze interno alla struttura dei nuclei agotati (pp. 84-93). *Garelli*, Sui punti di congelamento di miscugli isomorfi (pp. 97-104). *Giorzis*, Sul carbonato acido di tallio (pp. 104-109).

Anno 24. Vol. ii. Fascicolo 2. *Gazetta Chimica Italiana.* (31st Aug., 1894.)

Balbiano, L., Sopra un composto platinico della gliossalina (pp. 101-105). *Ciamician, G.*, e *Silber, P.*, Sintesi dell'etere trimetilico della benzoflosoglucina (metilidrocotoina o benzoilidrocotine) (pp. 105-111). *Zanetti, C. U.*, e *Levi, E.*, Sul tetraidrocarbazolo (pp. 111-118). *Ciamician, G.*, e *Silber, P.*, Sulla maclurina e floretina (pp. 118-127). *Angeli, A.*, e *Mole, P.*, Sopra il diisosafsolo e la cubebina (pp. 127-131). *Angeli, A.*, e *Malagnini, G.*, Sopra la configurazione di alcune gliossime (pp. 131-145). *Bartoli, A.*, e *Stracciati, E.*, Sulla variabilità del calore specifico dell'acqua fra $0°_e + 32°$ (pp. 145-152). *Bartoli, A.*, e *Stracciati, E.*, Il calore specifico dell'acqua sotto volume costante (pp. 152-156). *Bartoli, A.*, Sulla dipendenza della conducibilità elettrica degli eteri composti dalla temperatura (pp. 156-173). *Carrara, G.*, Sulle selenetine. Nuova serie di composti del selenis (pp. 173-179). *Paternò, E.*, e *Montemartini, C.*, Sulle variazioni di volume nei miscugli dei liquidi, in relazione al comportamento crioscopico (pp. 179-190). *Ferratini, A.*, Sui caratteri chimici delle diidrochinoline (pp. 190-196).

Anno 17. No. 7. *L'Orosi.* (July, 1894.)

Laguardia, P., Sulla ricerca tossicologica del silicato potassico (pp. 217-224).

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN SEPTEMBER, 1894.[1]

Vol. xlviii. No. 285. *American Journal of Science.* (September, 1894.)

Gooch, F. A., and *Phelps, I. K.*, Reduction of Arsenic Acid by the Action of Hydrochloric Acid and Potassium Bromide (pp. 216-219). *Pirsson, L. V.*, and *Wells, H. L.*, Occurrence of Leadhillite in Missouri and its Chemical Composition (pp. 219-226). *Hutchins, C. C.*, Thermo-Electric Heights of Antimony and Bismuth Alloys (pp. 226-230). *Peckham, S. F.*, Nitrogen Content of California Bitumen (pp 250-256). *Reis, H.*, Note on Artificial Crystals of Zinc Oxide (pp. 256-259).

Vol. xvi. No. 9. *Journal of the American Chemical Society.* (September, 1894.)

Smith, E. F., and *Burr, H. C.*, An Attempt to Prepare Molybdenum Hexachloride (pp. 577-578). *Smith, E. F.*, and *Hibbs, J. G.*, The Action of Hydrochloric Acid Gas upon Sodium Vanadate (pp. 578-580). *Curtman, C. O.*, On some of the Arsenic Tests of the U. S. Pharmacopœia, 1890 (pp. 580-587). *Bigelow, W. D.*, and *Hamilton, C. C.*, The Influence of Alum, Aluminium, Hydroxide and Aluminium Phosphate on the Digestibility of Bread (pp. 587-597). *Krug, W. H.*, Some Characteristics of California Wines (pp. 597-618). *M'Elroy, K. T. P.*, Contraction of Aqueous Solutions of Acetone (pp. 618-621). *Curtman, C. O.*, On the Hydration of Calcium Bromide and Iodide (pp. 621-624). *Lightfoot, I. M.*, A Study of the Chemical Behaviour of Arsenopyrite (pp. 624-633). *Osborne, T. B.*, The Proteids of the Kidney Bean (pp. 633-643). *Greiner, E.*, A New Automatic Pipette (pp. 643-644).

Vol. xix. No. 223. *The Analyst.* (October, 1894.)

Allen, A. H., On Extraneous Mineral Matter Contained in Commercial Ginger (pp. 217-220). *Clayton, E. G.*, Two Disputed Cases of Adulteration (pp. 220-221).

Vol. lxx. No. 1817. *Chemical News and Journal of Physical Science.* (21st September, 1894.)

Beadle, C., The Effects of Pressure upon the Breaking-Strain and Cleavage of Paper and Paper-Pulp (pp. 139-140). *Beadle, C.*, The Appearance of Chromates in Paper and Paper-Pulps (p. 140). *Edwards, V.*, The Estimation of Potash in Manures (p. 140).

Vol. lxx. No. 1818. (28th September, 1894.)

Wilson, R. H., The Composition of the Fen Soils of South Lincolnshire (pp. 153-154).

Vol. lxv. No. 383. *Journal of the Chemical Society.* (October, 1894.)

Perkin, A. G., and *Hummel, J. J.*, Colouring and other Principles Contained in Mang-Koudu.

Vol. lvi. No 337. *Proceedings of the Royal Society.* (21st September, 1894.)

Ramsay, W., and *Aston, E.*, The Molecular Surface-energy of the Esters, showing its Variation with Chemical Constitution (pp. 162-171). *Ramsay, W.*, The Complexity and the Dissociation of the Molecules of Liquids (pp. 171-182). *Ramsay, W.*, and *Aston, E.*, The Molecular Surface-energy of Mixtures of Non-associating Liquids (pp. 182-192). *Hartley, W. N.*, Flame Spectra at High Temperatures. II. The Spectrum of Metallic Manganese, of Alloys of Manganese and of Compounds Containing that Element (pp. 192-193). *Hartley, W. N.*, Flame Spectra at High Temperatures. III. The Spectroscopic Phenomena and Thermo-Chemistry of the Bessemer Process (pp. 193-199). *Barnett, R. E.*, On the Viscosity of Water as determined by Mr. J. B. Hannay by means of his Microrheometer (pp. 259-262).

Vol. xxxviii. No. 233. *Philosophical Magazine and Journal of Science.* (Oct., 1894.)

Wadsworth, F. L. O., Fixed-arm Spectroscopes (pp. 337-351). *Thomson, J. J.*, On the Velocity of the Cathode-Rays (pp. 358-365). *Whetham, W. C. D.*, On the Velocities of the Ions and the Relative Ionisation-Power of Solvents (pp. 392-396).

[1 It is proposed to continue this list for each month.—Ed.]

Serie 7. Tome iii. *Annales de Chimie et de Physique.* (October, 1894.)

Bouty, E., Sur les capacités de polarisation (pp. 145-209). *Desgrez, A.*, Contribution à l'étude des carbures saturés (pp. 209-246). *De Coppet, L. C.*, Recherches sur la température du maximum de densité de l'eau (pp. 246-268). *De Coppet, L. C.*, Sur la température du maximum de densité et sur la température de congélation des solutions de sucre de canne (pp. 268-275). *Étard*, Recherches expérimentales sur les solutions saturées (pp. 275-288).

Tomes xi.-xii. Nos. 16-17. *Bulletin de la Société Chimique de Paris.* (5th Sept., 1894.)

Moissan, H., Étude de quelques phénomènes nouveaux de fusion et de volatilisation produits au moyen de la chaleur de l'arc électrique (pp. 822-828). *Berthelot*, Les classifications et les symbols chimiques dans l'antiquité et au moyen âge (pp. 828-837). *Moissan, H.*, Sur la préparation d'une variété de graphite foisonnant (pp. 837-840). *Moissan, H.*, Nouvelles expériences sur la reproduction du diamant (pp. 840-845). *Wyrouboff, G.*, Quelques observations sur les amidochromates (pp. 845-853). *Lescoeur, H.*, Remarques sur certains chlorures métalliques hydratés (pp. 853-857). *Moissan, H.*, Préparation au four électrique de quelques métaux rèfractaires: tungstène, molybdène et vanadium (pp. 857-859). *Berthelot*, Sur quelques objets en cuivre, de date très ancienne, provenant de la Chaldée (pp. 859-861). *Berthelot*, Sur quelques nouveaux objets de cuivre provenant de l'ancienne Egypte (pp. 861-863). *Moissan, H.*, Sur la volatilisation de la silice et de la zircone et sur la réduction de ces composés par le charbon (pp. 863-865). *Moissan, H.*, Recherches sur la fer d'Ovifak (pp. 865-867). *Berthelot* et *Matignon*, Sur le nitrométhane et ses homologues (pp. 867-870). *Berthelot*, Sur les sulfates de propylène et de triméty-lène (pp. 870-873). *Berthelot*, Recherches sur la triméthylène et sur le propylène et sur une nouvelle classe de carbures d'hydrogène. Isomerie dynamique (pp. 873-878). *Berthelot*, Sur les substitutions des radicaux alcooliques liés à l'azote et au carbone (pp. 878-879). *Favre, C.*, Sur la condensation de l'aldéhyde formique avec les alcools de la série grasse en présence d'acide chlorhydrique (pp. 879-882). *Berg, A.*, Sur une réaction des acides-alcools (pp. 882-883). *Lepercq, G.*, Nitroso-butyrates de méthyle et d'éthyle (pp. 883-886). *Lepercq, G.*, Action des nitrites alcalins sur l'α-bromopropionate d'éthyle (pp. 886-888). *Genvresse*, Action du brome sur les éthers-oxydes en présence du soufre (pp. 888-891). *Naegeli, E.*, Notes diverses (pp. 891-898). *Berthelot*, Recherches sur la phénylhydrazine. Action de l'oxygène et action de l'eau; formation des sels (pp. 898-902). *Bouchardat, G.*, et *Lafont, J.*, Action de l'acide sulfurique sur le camphene (pp. 902-905). *Guerbet*, Sur un nouvel acide isomérique de l'acide campholique (pp. 905-908). *Marie, T.*, Sur l'extraction des acides libres de la cire d'abeilles (pp. 908-911).

Tome cxix. No. 10. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (3rd September, 1894.)

Pichard, P., Assimilabilité de la potasse, en sols siliceux pauvres, par l'action des nitrates (pp. 471-474). *Gaud, F.*, Sur un nouveau dosage pondéral du glucose (pp. 478-479). *Onimus, E.*, Phénomènes consecutifs à la dialyse des cellules de la levure de bière (pp. 479-480).

Tome cxix. No. 12. (17th September, 1894.)

De Kowalski, J., Sur le mélange des liquides (pp. 512-514).

Tome cxix. No. 13. (24th September, 1894.)

Pictet, R., Recherches expérimentales sur l'influence des basses températures sur les phénomènes de phosphorescence (pp. 527-529).

Tome cxix. No. 14. (1st October, 1894.)

Pictet, R., Influence des basses températures sur les lois de la cristallisation (pp. 554-557). *Joannis, A.*, Action du phosphure d'hydrogène sur le potassammonium et le sodammonium (pp. 557-559). *Varet, R.*, Recherches sur le picrate mercurique (pp. 559-562). *Varet, R.*, Action de l'acide picrique et des picrates sur les cyanures métalliques. Les isopurpurates (pp. 562-563). *Trillat, A.*, Propriétés antiseptiques des vapeurs de formol (pp. 563-565). *Balland*, Observations sur les farines (pp. 565-567).

Tome xxx. No. 6. *Journal de Pharmacie et de Chimie.* (15th September, 1894.)

Halphen, G., Contribution à l'analyse des saindoux (pp. 241-247). *Benoit*, De l'emploi du calcimètre de Mohr pour le dosage des carbonates employés en pharmacie (pp. 247-249). *François*, Dosage du mercure en présence de l'iode (pp. 249-254).

Tome xxx. No. 7. (1st October, 1894.)

Riche, A., et *Halphen, G.*, Nouvelles recherches sur les pétroles (pp. 289-300). *Allein* et *Gaud*, Sur certains produits de décomposition du glucose (pp. 300-305). *Allein* et *Gaud*, Sur un nouveau mode de dosage du glucose par la liqueur cuproalcaline (pp. 305-307). *Villiers, A.*, et *Fayolle*, Sur une réaction des aldéhydes. Différenciation des aldoses et des cétoses (pp. 307-310).

Band cclxxx. Heft 2 und 3. *Justus Liebig's Annalen der Chemie.* (29th Aug., 1894.)

Vorländer, D., Ueber Aethylenester zweibasischer Säuren und Phenole (pp. 167-207). *Kirchhoff, H.*, Zur Kenntniss der disubstituirten Bernsteinsäuren (pp. 207-216). *Van der Riet, B. S.*, Ueber gechlorte Bernsteinsäuren und Chlormaleïnsäure (pp. 216-233). *Tambach, R.*, Ueber Thiohydantoïnessigsäure und Diphenylthiohydantoïnessigsäure (pp. 233-247). *Weinig, M.*, Zur Kenntniss der α-Brompropionsäure (pp. 247-252). *Weinig, M.*, Ueber Dimethacrylsäure (pp. 252-259). *Ariff, M.*, Ueber α-β-Dibromisovaleriansäure (pp. 259-263). *Nef, J. U.*, Ueber die Constitution der Salze der Nitroparaffine (pp. 263-291). *Nef, J. U.*, Ueber das zweiwerthige Kohlenstoffatom. II. (pp. 291-343).

Band cclxxxi. Heft 2 und 3. (12th September, 1894.)

Lossen, W., Ueber amidartige Derivate des Hydroxylamins. 18. Ueber das Auftreten polymorpher Modificationen bei Hydroxylaminderivaten (pp. 169-306). *Claisen, L.*, Untersuchungen über die Oxymethylenverbindungen (pp. 306-314). *Bishop, A. W.*, *Claisen, L.*, und *Sinclair, W.*, Ueber den Oxymethylencampher (pp. 314-398).

Band ccxxxii. Heft 5. *Archiv der Pharmacie.* (15th September, 1894.)

Fischer, B., und *Grutzner, B.*, Ueber Quecksilberformamid (pp. 329-334). *Kiliani, H.*, und *Bazlen, M.*, Ueber neue Derivate des Digitogenins (pp. 334-346). *Boettinger, C.*, Ueber Harnstoffabkömmlige der Tribrombrenztraubensäure (pp. 346-349). *Boettinger, C.*, Ueber eine neue Bildungsweise der Sulfuvinsäure (pp. 349-351). *Engler, C.*, und *Dieckhoff, E.*, Ueber wasserlösliche Kresolpräparate (pp. 351-365). *Salzer, T.*, Ueber Natriumpyrophosphate (pp. 365-375). *Beckurts, H.*, Ueber die Veränderung, welche das Wasser der Oker und Aller durch die Abwässer der Chlorkaliumfabrik der Gewerkschaft Thiederhall erliedet (pp. 375-408).

Jahrgang xxvii. No. 14. *Berichte der Deutschen Chemischen Gesellschaft.* (24th September, 1894.)

Classen, A., Quantitative Analyse durch Elektrolyse (pp. 2060-2081). *Zaloziecki, R.*, Ueber terpenartige Kohlenwasserstoffe im Erdöl (pp. 2081-2088). *Ahrens, F. B.*, Ueber die Einwirkung von Piperidin auf Acetessigester (pp. 2088-2090). *Ahrens, F. B.*, Ueber die Einwirkung von Chloroform und Aetzkali auf Piperidin (pp. 2090-2092). *Bredt, J.*, Ueber die Constitution des Camphers. II. (pp. 2092-2099). *Hantzsch, A.*, Bemerkungen über Stereoisomerie der benzoldiazosulfonsauren Salze (pp. 2099-2102). *Bruner, L.*, Ueber die Schmelzwärmen einiger organischen Verbindungen (p. 2102). *Haeussermann, C.*, und *Teichmann, H.*, Zur Kenntniss der Diphenole. I. (pp. 2107-2109). *Staedel, W.*, Abkömmlinge des Diphenylmethans und Benzophenons (pp. 2109-2112). *Staedel, W.*, Notiz über m-Nitrobenzylalkohol (p. 2112). *Aschan, O.*, Ueber eine neue Spaltungsreaction des Bromcamphersäureanhydrids (pp. 2112-2116). *Kühling, O.*, Ueber die Oxydation des Tolualloxazins (pp. 2116-2119). *Herzig, J.*, Ueber die Aetherificirung der aromatischen Hydroxylgruppe (pp. 2119-2121). *V. Pechmann, H.*, und *Seeberger, L.*, Ueber die Einwirkung von Phosphorpentachlorid auf s-Benzoylphenylhydrazin (pp. 2121-2125). *Schunck, E.*, und *Marchlewski, L.*, Zur Kenntniss des Anthrachinonoxims (pp. 2125-2126). *Michael, A.*, Ueber die Einwirkung von Natriummalonäthylester auf Benzalaceton (pp. 2126-2130). *Michael, A.*, Ueber die Brommesaconsäure (pp. 2130-2131). *Otto, R.*, Löslichkeit des Phenylhydrazins in wässrigen Lösungen der Alkalisalze von Sulfinsäuren, Sulfonsäuren, Fettsäuren und Gallensäuren (pp. 2131-2133). *Balbiano, L.*,

Ueber die Oxydation der Camphersäure (pp. 2133-2137). *Dressel, O.*, und *Kothe, R.*, Ueber Sulfirungen in der Naphtalinreihe (pp. 2137-2154). *Rehländer, P.*, Ueber einige Oxazoline und Thiazoline der Anissäurereihe (pp. 2154-2161). *Banse, G.*, Ueber einige Abkömmlinge des p-Cyantoluols (pp. 2161-2172). *Lehmann, M.*, Ueber einige geschwefelte Abkömmlinge des Propylamins (pp. 2172-2178). *Hinsberg, O.*, Ueber die Einwirkung von Phosphortri- und Pentachlorid auf o-Toluylendiamin (pp. 2178-2181). *Hinsberg, O.*, und *König, F.*, Ueber einige hydrirte Chinoxaline (pp. 2181-2187). *Hinsberg, O.*, und *Funcke, Fr.*, Ueber die Aldehydinreaction (pp. 2187-2193). *Werner, A.*, und *Buss, H.*, Ueber Benzhydroximsäurechlorid (pp. 2193-2201). *Meldola, R.*, und *Streatfield, J. W.*, Notiz über Paradinitrodiazoamidobenzol (pp. 2201-2203). *Fischer, E.*, und *Hunsalz, P.*, Ueber den Hydrazinoacetaldehyd. II. (Hydrazinoäthanal) (pp. 2203-2209). *Haeussermann, C.*, und *Grell, Fr.*, Zur Kenntniss der Dinitrotoluole (pp. 2209-2211). *Graess, F.*, und *Ammelburg, A.*, Ueber das Verhalten einiger Nitro-β-diazonaphtaline (pp. 2211-2215). *Kossel, A.*, und *Neumann, A.*, Darstellung und Spaltungsproducte der Nucleïnsäure (Adenylsäure) (pp. 2215-2222). *Erlenmeyer, E., jun.*, und *Knight, N.*, Ueber die Entstehung von Oxylactonen aus Phenylbrenztraubensäure (pp. 2222-2227). *Jannasch, P.*, und *Rose, E.*, Ueber Metalltrennungen in alkalischer Lösung durch Wasserstoffsuperoxyd (pp. 2227-2232). *Damerow, F.*, Synthese des 3-Aethylisochinolins (pp. 2232-2244). *Reissert, A.*, Ueber hydrirte Naphtinoline (pp. 2244-2260). *Schall, C.*, Zur Existenz stereomerer Carbodiphenyl- und Ditolylimide. Entgegnung auf die Ansicht der Herren W. v. Miller und J. Plöchl (pp. 2260-2263). *Bodländer, G.*, Das Gasbaroskop und dessen Anwendung für die Stickstoff bestimmung nach Dumas und für die Bestimmung der Dampfdichte nach V. Meyer (pp. 2263-2270). *Wagner, G.*, Zur Oxydation cyklischer Verbindungen (pp. 2270-2276). *Harries, C. D.*, Aethanhydrazoäthan (pp. 2276-2282). *Rimbach, E.*, Ueber das Verhältniss der Saccharimetergrade zu Kreisgraden für Natriumlicht (pp. 2282-2285). *V. Laszczynski, St.*, Ueber die Loslichkeit einiger anorganischer Salze in organischen Flüssigkeiten (pp. 2285-2288). *Biltz, H.*, Phenylhydragone des Salicylaldehyds (pp. 2288-2290). *Koenigs, W.*, und *Hoerlin, J.*, Ueber das Cinchotin oder Hydrocinchonin (pp. 2290-2293). *Gattermann, L.*, und *Rüdt, H.*, Ueber die Condensation aromatischer Alkohole mit Nitrokohlenwasserstoffen (pp. 2293-2297). *Tafel, J.*, Ueber das Verhalten des Natriumsuperoxyds gegen Alkohol (pp. 2297-2306). *Kann, M.*, und *Tafel, J.*, Ueber α-Phenyläthylamin (Amino-1^1-äthylbenzen) (pp. 2306-2309). *Senfter, L.*, und *Tafel, J.*, Ueber γ-Phenylpropylamin (Amino-1^3-propylbenzen) und seine Ueberführung in Allylbenzol (Propenyl-1^1-benzen) (pp. 2309-2313). *Senfter, L.*, und *Tafel, J.*, Zur Kenntniss der γ-Amidovaleriansäure (Amino-4-pentansäure) und des Methylpyrrolidons (pp. 2313-2315). *Beckh, W.*, und *Tafel, J.*, Zur Kenntniss des Diazoamidobenzols (pp. 2315-2316). *Schöpff, M.*, Ueber symmetrisches Diamidoacridon (pp. 2316-2321). *Schöpff, M.*, Condensationen mit Formaldehyd (pp. 2321-2326). *Willgerodt, C.*, Ueber die Existenz der Metajodoso- der Metajodo- und der p-Jodosobenzoësäure (pp. 2326-2337). *Knoevenagel, E.*, Ueber Derivate des 1, 3-Diketocyclohexans (Dihydroresorcins) (pp. 2337-2345). *Knoevenagel, E.*, Ueber eine Darstellungsweise der Glutarsäure (pp. 2345-2347). *Knoevenagel, E.*, Synthese des symmetrischen Carvacrols (pp. 2347-2348). *Beckmann, E.*, Ueber Campherpinacon (pp. 2348-2351). *Witt, O. N.*, und *Helmolt, H. v.*, Ueber die Reductionsproducte alkylirter Azofarbstoffe der Naphtalinreihe. III. (pp. 2351-2358). *Witt, O. N.*, und *Buntrock, A.*, Ueber die Reductionsproducte alkylirter Azofarbstoffe der Naphtalinreihe. IV. (pp. 2358-2363). *Lesser, R.*, Zur Kenntniss der Monosulfosäuren des Phenyl-β-Naphtylamins und der aus ihnen entstehenden Azofarbstoffe (pp. 2363-2370). *Witt, O. N.*, und *Schmitt, G.*, Ueber naphtylirte Benzolsulfamide und Toluolsulfamide (pp. 2370-2378). *Brühl, J. W.*, Studien über Tautomerie (2378-2398). *Aschan, O.*, und *Brühl, J. W.*, Tautomerisation von Oxymethylenverbindungen (pp. 2398-2405). *Stobbe, H.*, und *Kloeppel, E.*, Ueber die Einwirkung von Natriumäthylat auf Benzaldehyd und Bernsteinsäurediäthylester (pp. 2405-2409). *Manasse, O.*, Ueber eine Synthese aromatischer Oxyalkohole (pp. 2409-2413). *Paal, C.*, und *Vanvolxem, L.*, Ueber die Constitution der Söderbaum-Widmanschen Phendihydroaci- und Thiomiazine (pp. 2413-2427). *Paal, C.*, und *Commerell, O.*, Synthesen von Cumothiazonderivaten (pp. 2427-2434). *Wagner, G.*, Synthese ungesättigter Alkohole (pp. 2434-2439). *Einhorn, A.*, und *Willstätter, R.*, Ueber das Methylbetaïn des Anhydroecgonins (pp. 2439-2455). *Einhorn, A.*, und *Frey, C.*, Zur Kenntniss des Eugenols und Isoeugenols (pp. 2455-2461). *Einhorn, A.*, und *Hofe, C. v.*, Ueber die Phenacyl- und Acetonyleugenole (pp. 2461-2466). *Einhorn, A.*, und

Meyenberg, A., Ueber die Hexahydroanthranilsäure und die Hexahydrosalicylsäure (pp. 2466-2475). *Dieckmann, W.*, Reduction des β-Ketohexamethylencarbonsäureesters zur Hexahydrosalicylsäure (pp. 2475-2478). *Fischer, E.*, und *Beensch, L.*, Ueber einige synthetische Glucoside (pp. 2478-2486). *Fischer, E.*, und *Beensch, L.*, Ueber einige Osazone und Hydrazone der Zuckergruppe (pp. 2486-2492). *Gabriel, S.*, und *Posner, T.*, Zur Kenntniss des o-o$_1$-α-Tricyandibenzyls (pp. 2492-2507). *Busch, M.*, Ueber eine neue Reactionzwischen Schwefelkohlenstoff und primären Hydrazinen (pp. 2507-2520). *Semmler, F. W.*, Ûeber Linaloolen $C_{10}H_{18}$ (pp. 2520-2521). *Jannasch, P.*, und *Weiler, M.*, Ueber die Einwirkung von Natrium auf Monobrommesitylen (pp. 2521-2526). *Ingle, H.*, Ueber Paradiacetylbenzol (pp. 2526-2529). *Hantzsch, A.*, und *Freese, H.*, Schwefelhaltige Begleiter der Anilinbasen und deren Farbenreactionen (pp. 2529-2535). *Blau, F.*, Zur Constitution des Nicotins. IV. (pp. 2535-2540). *Loth, F.*, und *Michaelis, A.*, Ueber die Einwirkung von Thionylchlorid auf einige organische Verbindungen (pp. 2540-2549). *Klieeisen, J.*, Ueber die Thionylverbindungen substituirter Phenylhydrazine und der Hydrazinbenzoësäuren (pp. 2549-2556). *Michaelis, A.*, Ueber die o- und n-Chlorphosphine der aromatischer Reihe (pp. 2556-2559). *Kunz, P.*, Ueber die o-Chlorphosphine des Phenols und der Naphtole (pp. 2559-2565). *Knauer, W.*, Ueber die o-Chlorphosphine der zweiatomigen Phenole (pp. 2565-2572). *Michaelis, A.*, und *Schulze, G.*, Ueber die n-Oxychlorphosphine der aromatischen Amine. II. (pp. 2572-2580). *Tiemann, F.*, Zur Umwandlung des Eugenols in Isoeugenol (pp. 2580-2582). *Bamberger, E.*, Ueber Stereomerie bei Diazoverbindungen und die Natur der Isodiazokörper (pp. 2582-2596). *Bamberger, E.*, Ueber die "stereoisomeren" Diazoamidoverbindungen von A. Hantzsch (pp. 2596-2601). *Bamberger, E.*, Zur Constitution der Diazobenzolsäure (pp 2601-2611). *Wolffenstein, R.*, Ueber Conium-Alkaloïde (pp. 2611-2615). *Wolffenstein, R.*, Ueber Coniin (pp. 2615-2621). *Gradenwitz, H.*, Zur Kenntniss der β-Oxynaphtoësäure vom Schmelzpunkt 216° (pp. 2621-2624). *Heuck, R.*, Ueber Furalcyanacrylsäure und deren Derivate (pp. 2624-2627). *Täuber, E.*, Ueber die einseitige Diazotirung des Benzidins (pp. 2627-2632). *Bistrzycki, A.*, und *Oehlert, G. J.*, Ueber Condensationsproducte von o-Aldehydsäuren mit Phenolen. I. (pp. 2632-2640).

Band l. Nos. 18, 19, 20. *Journal für praktische Chemie.* (15th Sept., 1894.)

Curtius, T., und *Dedichen, G. M.*, Synthesen von Benzolhydrazinen mittelst Hydrazinhydrat (pp. 241-275). *Curtius, T.*, Hydrazide und Azide organischer Säuren. I. (pp. 275-295). *Struve, G.*, Ueber Benzhydrazid (pp. 295-311). *Curtius, T.*, und *Schrader, F.*, Metalldoppelsalze des Diammoniums und Diamids (pp. 311-347). *Vaubel, W.*, Ueber das Verhalten der Triphenylmethanfarbstoffe gegen nascirendes Brom. I. (pp. 347-351). *Vaubel, W.*, Beitrag zur Kenntniss der Triphenylmethanfarbstoffe (pp. 351-362). *Vaubel, W.*, Der Benzolkern. III. (pp. 362-367). *Vaubel, W.*, Ueber das Verhalten einiger stickstoffhaltiger Kerne gegen nascirendes Brom (pp. 367-370). *Fileti, M.*, und *Ponzio, G.*, Ueber das 2, 3-Undekadion (pp. 370-378). *Fileti, M.*, und *Baldracco, G.*, Ueber die Constitution der Oxybehensäure (Ketobehensäure) (pp. 378-380). *Gustavson, G.*, Ueber die Produkte der Einwirkung des chlors auf Trimethylen (pp. 380-383). *Haeussermann, C.*, Notiz über das ameisensaure Chromoxyd (pp. 383-384).

Band xv. Heft 6. *Monatshefte für Chemie und verwandte Theile anderer Wissenschaften.* (31st July, 1894.)

Emich, F., Ueber die Einwirkung des stickoxydes auf einige Metalle bei höherer Temperatur (pp. 375-391). *Prelinger, O.*, Ueber Stickstoffverbindungen des Mangans (pp. 391-402). *Lachowicz, B.*, Zur Einwirkung der Anilinbasen auf Benzoin (pp. 402-404). *Lieben, A.*, Bemerkungen über die Constitution der felten Säuren und die Löslichkeit ihrer Salze (pp. 404-415). *Johann, G.*, Ueber die aus der Einwirkung von Blausäure auf ungesättigte Aldehyde hervorgehenden Verbindungen. II. (pp. 415-427).

Jahrgang xxxiii. Heft 4. *Zeitschrift für Analytische Chemie.* (Oct., 1894.)

Foerster, F., Vergleichende Prüfung einiger Glassorten hinsichtlich ihres chemischen Verhaltens (pp. 381-397). *Von Raumer, E.*, Ueber die Zusammensetzung des Honigthaus und über den Einfluss an Honigthau reicher sommer auf die Beschaffenheit des Bienenhonigs (pp. 397-409). *Lonnes, C.*, Jodometrische Versuche und Beitrag zur Kenntniss der Jodstärke (pp. 409-437). *Hoffmeister, W.*, Ein verbesserter Trochenkasten (pp. 437-438). *Sidersky, D.*, Neuer Apparat für Maassanalyse (pp. 438-441). *Tecler, N.*, Zur Frage der continuirlich wirkenden Gasentwickler (pp. 441-446).

Band vii. Heft 3. *Zeitschrift für Anorganische Chemie.* (6th Sept., 1894.)

Gooch, F. A., und *Phelps, I. K.*, Ueber die Reduktion der Arsensäure durch Einwirkung von Salzsäure und Bromkalium (pp. 123-127). *Gooch, F. A.*, und *Moseley, H. P.*, Nachweis und annähernde Bestimmung geringer Mengen von Arsen im Kupfer (pp. 127-132). *Gooch, F. A.*, und *Howland, J.*, Jodometrische Bestimmung der Tellursäure (pp. 132-137). *Seubert, K.*, und *Rohrer, R.*, Ueber die Einwirkung von Ferrisulfat auf Jodkalium und Jodwasserstoff (pp. 137-154). *Jannasch, P.*, und *Locke, J.*, Analyse eines Apatits aus grossblättrigem Graphit von Ceylon (pp. 154-158). *Browning, P. E.*, Reduktion der Vanadinsäure durch Einwirkung von Weinsäure und Titration derselben in alkalischer Lösung durch Jod (pp. 158-161). *Gurcman, A.*, Zur Kenntnis der Elektrolyse der Nitrosylschwefelsäure in schwefelsaurer Lösung (pp. 161-167). *Arclowski, H.*, Untersuchungen über die Flüchtigkeit des Quecksilberchlorides (pp. 167-176). *Rosenheim, A.*, Ueber schwefligmolybdansäure Salze (pp. 176-185).

Band vii. Heft 4. (26th September, 1894.)

Lunge, G., und *Porschnew, G.*, Zur Kenntniss des Stickstofftrioxyds (Salpetrigsäureanhydrids) (pp. 209-250). *Dennis, L. M.*, und *Magee, W. H.*, Beiträge zur Chemie des Cers (pp. 250-265). *Retgers, J. W.*, Ueber eine einfache Darstellungsweise des Phosphorwasserstoffes (pp. 265-267). *Clarke, F. W.*, Die Konstitution der Zeolithe (pp. 267-275).

Band xv. Heft 1. *Zeitschrift für Physikalische Chemie.* (18th Sept., 1894.)

Rothmund, V., Die Potentialdifferenzen zwischen Metallen und Elektrolyten (pp. 1-33). *Auwers, K.*, Zur Frage der Konstitutionsbestimmung auf kryoskopischenn Wege (pp. 33-56). *Schmidt, G. C.*, Ueber Adsorption (pp. 56-65). *Spring, W.*, Ueber das Vorkommen gewisser für den Flüssigkeits- oder Gaszustand charakteristischen Eigenschaften bei festen Metallen (pp. 65-79). *Drude, P.*, und *Nernst, W.*, Ueber Elektrostriktion durch freie Ionen (pp. 79-86). *Küster, F. W.*, Der Schmelzpunkt von Gemischen isomorpher Salze (pp. 86-89). *Ramsay, W.*, und *Aston, E.*, Die molekulare Oberflächenenergie von Mischungen sich nicht assocüerender Flüssigkeiten (pp. 89-98). *Ramsay, W.*, und *Aston, E.*, Die molekulare Oberflächenenergie der Ester und ihre Änderung mit der chemischen Konstitution (pp. 98-106). *Ramsay, W.*, Die Komplexität und Dissociation von Flüssigkeitsmolekeln (pp. 106-117). *Tanatar, S.*, Zur Theorie der elektrolytischen Dissociation (pp. 117-124). *Tanatar, S.*, *Choina, J.*, und *Kozireff, D.*, Die depression einiger Körper in Alkohol-Wasser-Gemischen (pp. 124-126). *Kohlrausch, F.*, Ueber Widerstandsbestimmung von Elektrolyten mit Konstanten oder mit Wechselströmen (pp. 126-140).

Anno 24. Vol. ii. Fascicolo 3. *Gazetta Chimica Italiana.* (30th Sept., 1894.)

Paternò, E., e *Montemartini, C.*, Il paraxilene quale solvente nelle ricerche crioscopische (pp. 197-208). *Paternò, E.*, e *Montemartini, C.*, Sul massimo abbassamento nella temperatura di congelamento dei miscugli (pp. 208-222). *Pellizzari, G.*, I. Nuova sintesi del triazolo e dei suoi derivati (pp. 222-229). *Garelli, F.*, e *Montanari, C.*, II. Sul comportamento crioscopico di sostanze aventi costituzione simile a quella del solvente (pp. 229-263). *Garelli, F.*, Sui punti di congelamento di miscugli isomorfi (pp. 263-274). *Serono, C.*, Sull'idrato piroantimonioso (pp. 274-276).

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN OCTOBER, 1894.

Vol. xlviii. No. 287. *American Journal of Science.* (November, 1894.)

Gooch, F. A., and *Howland, J.*, An Iodometric Method for the Estimation of Telluric Acid (pp. 375-379). *Lea, M. C.*, New Methods of Obtaining Platinochlorides. Probable Existence of a Platinum Subchloride (pp. 397-401). *Riggs, R. B.*, Qualitative Separation of Chromium from Iron and Aluminium (pp. 409-411). *Washington, H. S.*, Copper Crystals in Aventurine Glass (pp. 411-418). *Campbell, G. F.*, Caesium-Cobalt and Caesium-Nickel Double Chlorides, Bromides, and Iodides (pp. 418-421).

Vol. xvi. No. 10. *Journal of the American Chemical Society.* (October, 1894.)

Dennis. L. M., and *Magee, W. H.*, Contributions to the Chemistry of Cerium (pp. 649-665). *Wolfbauer, F.*, Method for the Determination of the Freezing Point of Fatty Acids (pp. 665-670). *Ross, B. B.*, Recent Work on the Sugars (pp. 670-673). *Beal, W. H.*, The Determination of Volatile and Insoluble Fatty Acids in Butter Fat (pp. 673-677). *Gird, W. K.*, A Gravimeter for Sugar Analysis (pp. 677-678). *Curtman, C. O.*, On the Quality of Potassium Iodide, Sold in the Market as U. S. P. (pp. 678-682). *Eddy, H. E.*, Sewage Disposal at Worcester, Mass. (pp. 682-688). *Noyes, W. A.*, *Blinks, W. M.*, and *Mory, A. V. H.*, Oil Gas (pp. 688-697). *Noyes, W. A.*, and *Blinks, W. M.*, The Determination of Benzene in Illuminating Gas (pp. 697-699). *Green, F. T.*, A Device for the Adjustment of a Balance (p. 699). *Phillips, F. C.*, Note on a Form of Silver Obtained in the Reduction of the Sulphide by Hydrogen (pp. 700-703). *Osborne, T. B.*, The Proteids of the Kidney Bean (pp. 703-712). *Van Slyke, L. L.*, The Determination of Albumen in Cow's Milk (pp. 712-715). *Rice, C.*, An Apparatus ("Lysometer") for Determining Solubilities (pp. 715-717).

Vol. xvi. No. 11. (November, 1894.)

Stone, W. E., and *Scheuch, F. C.*, A Method for Determining Calcium Oxide in Quicklime (pp. 721-726). *Stone, W. E.*, A Comparison of Methods for the Determination of Starch (pp. 726-733). *Mason, W. P.*, Notes on the Hardening of Mortar (pp. 733-735). *De Benneville, J. S.*, Some Alloys of Iron with Molybdenum, Tungsten and Chromium as Solutions (pp. 735-757). *Osborne, T. B.*, The Proteids of the Kidney Bean (pp. 757-764). *Parker, C. E.*, A Safety Attachment for Riders (pp. 764-765). *Kilgon, B. W.*, On the Estimation of Phosphoric Acid by Filtration of the Yellow Precipitate (pp. 765-772). *Mason, W. P.*, The Quality of Water Supplies (pp. 772-778). *Osborne, T. B.*, and *Voorhees, C. G.*, The Proteids of Cottonseed (pp. 778-785). *Keller, H. F.*, On the Analysis of American Refined Copper (pp. 785-789).

Vol. lxv. No. 384. *Journal of the Chemical Society.* (November, 1894.)

Chattaway, F. D., and *Lewis, W. H.*, Phenylnaphthalenes II. β-Phenylnaphthalene (pp. 869-875). *Chattaway, F. D.*, and *Lewis, W. H.*, Preparation of β-Chloronaphthalene (pp. 875-877). *Chattaway, F. D.*, Note on β-Mercurydinaphthyl and ββ-Dinaphthyl (pp. 877-879). *Boyd, D. R.*, Reduction of Paratolueneazodimethylaniline (pp. 879-889).

Tome iii. *Annales de Chimie et de Physique.* (November, 1894.)

Berg, A., Étude sur les dérivés chlorés des ammoniaques composées (pp. 289-362). *Battelli, A.*, Des propriétés thermiques des vapeurs (pp. 408-431). *Berthelot*, Sur la sublimation des iodures rouge et jaune de mercure (pp. 431-432).

Tomes xi.-xii. Nos. 18-19. *Bulletin de la Société Chimique de Paris.* (5th Oct., 1894.)

Barillot, E., Sur un nouvel appareil rectificateur à analyseurs et à plateaux rétrogradeurs (pp. 929-931). *Tassilly*, Étude thermique de l'oxybromure et de l'oxyiodure de calcium (pp. 931-933). *Chancel, F.*, Sur la propylpropylidène-amine (p. 933). *Chancel, F.*, Sur les propylacétamides (pp. 934-935). *Chancel, F.*, Sur la tetrapropylurée (pp. 935-937). *Cazeneuve, P.*, À propos de l'acide triacétylgallique. Résponse à M. Hugo Schiff (pp. 937-938). *Sisley, P.*, Sur l'acids triacétylgallique (pp. 938-939). *Béhal, A.*, et *Choay, E.*, Composition quantitative des créosotes de bois de hêtre et de bois de chêne (pp. 939-944.) *Tanret*, Sur la picéine, glucoside de feuilles du sapin épicéa (pinus picea)

(944-949). *Tanret*, Sur une nouvelle glucosane, la lévoglucosane (pp. 949-955). *Moissan, H.*, Sur le dosage du bore (pp. 955-958). *Barillot, E.*, Recherche toxicologique et dosage de l'arsenic (pp. 958-959). *Moreigne, H.*, Dosage de l'azote urinaire total (pp. 959-975). *Moreigne, H.*, Quelques observations relatives au dosage du soufre total urinaire (pp. 975-977). *Bedout*, Note sur une nouveau compteur à liquides (pp. 977-986).

Tome cxix. No. 15. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (8th October, 1894.)

Longuinine, W., Étude des chaleurs latentes de vaporisations des alcools saturés de la série grasse (pp. 601-604). *Gaud, F.*, Sur une cas particulier de l'attaque du glucose par les alcalis (pp. 604-607). *Cambier, R.*, et *Brochet, A.*, Sur la production de l'aldéhyd formique gayeux destiné à la désinfection (pp. 607-609). *Heibling, J.*, Fabrication de l'alumine au moyen des argiles (pp. 609-610).

Tome cxix. No. 16. (15th October, 1894.)

Pictet, R., Recherches expérimentales sur la congélation de l'acide sulfurique à différents degrés de concentration (pp. 642-645). *Longuinine, W.*, Application de la loi de Trouton aux alcools saturés de la série grasse (pp. 645-647). *Vaillant, V.*, Action du chlorure de soufre sur les dérivés cupriques de l'acétylacétone et de la benzoylacétone (pp. 647-650). *Gaud, F.*, Sur les dosages de glucose par liqueurs cupro-alcalines (pp. 650-652). *Renard, A.*, Sur le goudron de pin (pp. 652-654). *Perret, J.*, Action des sables et des eaux du Sahara sur les ciments et chaux hydrauliques (pp. 654-656).

Tome cxix. No. 17. (22nd October, 1894.)

Pictet, R., Recherches expérimentales sur le point de congélation des différents mélanges d'alcool et d'eau (pp. 678-682). *Metzner, R.*, Étude des combinaisons de l'anhydride fleurhydrique avec l'eau (pp. 682-684). *Varet, R.*, Recherches sur les sulfates mercuriques (pp. 684-687). *Baubigny, H.*, Le vermillion d'antimoine n'est pas un oxysulfure (pp. 687-690). *Causse, H.*, Nitrosalicylates de bismuth (pp. 690-693).

Tome cxix. No. 18. (29th October, 1894.)

Berthelot et *André, G.*, Sur l'existence, dans les végétaux, de principes dédoublables avec production d'acide carbonique (pp. 711-714). *Ponsot*, Relation entre les tensions maxima de vapeur de l'eau, de la glace et d'une solution saline au point de congélation de cette solution (pp. 731-733). *Dosmond*, Sur les produits gazeux qui se dégagent du charbon de bois lorsqu'il est soumis à une haute température à l'abri du contact de l'air (pp. 733-735). *Charpy, G.*, Sur les températures de transformation des fers et aciers (pp. 735-737). *Baubigny, H.*, Sur la kermésite (pp. 737-740). *Guye, A. Ph.*, et *Gaulier*, Superposition des effets optiques des divers carbones asymétriques dans une même molecule active (pp. 740-743). *Welt, I.*, Sur les hydrocarbures saturés à radicaux amyliques actifs (pp. 743-747). *Fabre, C. Garrigou*, et *Surre*, Sur le dosage de l'alcool dans les huiles essentielles (pp. 747-748).

Tome xxx. No. 8. *Journal de Pharmacie et de Chimie.* (15th October, 1894.)

Vaudin, L., Sur la composition chimique du colostrum de la vache (pp. 337-339). *Maître, A.*, Vins de dattes et vins de figues (pp. 339-344). *Wunsch, A.*, Sur la benzoïlquinine (pp. 344-347). *Moureu, C.*, Sur l'ecgonine et ses dérivés (pp. 347-353).

Tome xxx. No. 9. (1st November, 1894.)

Bouchardat et *Lafont*, Action de l'acide sulfurique sur le camphène (pp. 385-388). *Grimbert, L.*, Le bacille virgule dans ses rapports avec le choléra Asiatique (pp. 388-396). *Chassy, A.*, Sur l'electrolyse de sulfate de cuivre (pp. 396-398). *Moureu*, Action du chlorure de thionyle (acide chlorosulfureux) sur quelques composés minéraux et organiques (pp. 398-401). *Renard, A.*, Sur le goudron de pin (pp. 401-403).

Tome xxvi. No. 6. *Journal de la Société Physico-chimique Russe.*

Decker, H., Action des alcalis sur les haloidhydrates de la quinoléine et des composés analogues (pp. 265-326). *Bakhmetieff*, Les propriétés physiques des amalgames du cadmium (pp. 265-286).

Band cclxxxii. Heft 1 und 2. *Justus Liebig's Annalen der Chemie.* (10th Oct., 1894.)

Volhard, J., Synthese und Constitution der Vulpinsäure (pp. 1-21). *Schenck, R.*, Ueber Pulvinaminsäuren und Pulvinsäureester (pp. 21-45). *Volhard, J.*, und *Henke, F.*, Ueber

die Derivate des Diphenylketipinsäuredinitrils oder Oxalylbisbenzylcyanürs (pp. 45-85). *Claus, Ad.*, Ueber Alkylderivate substituirter Cinchoninsäuren III. (p. 85). *Claus, Ad.*, und *Brandt, G.*, p-Methoxy-α-phenylcinchoninsäure, p-Oxycinchoninsäure, und p-Oxy-α-phenylcinchonin (pp. 85-107). *Claus, Ad.*, und *Steinitz, J.*, Alkylderivate der Chinaldin-β-carbonsäure (pp. 107-130). *Claus, Ad.*, und *Steinitz, J.*, Ueber Ester und Betaïne von Chinolinsulfonsäuren (pp. 130-139). *Rassow, B.*, Ueber die stereoisomeren p-Phenylhexahydrobenzoësäuren (pp. 139-153). *Bernhard, Ad.*, Ueber die Einführung von Acylen in den Benzoylessigäther (pp. 153-191). *Hesse, O.*, Zur Kenntniss der in der echten Cotorinde enthaltenen krystallisirbaren Stoffe (pp. 191-208). *Hesse O.*, Beitrag zur Kenntniss der Opiumalkaloïde (pp. 208-214). *Kluge, F.*, Zur Köhnlein, schen Darstellung der Paraffine (pp. 214-229). *Heinlen, A.*, Ueber Propan und Aethan im flüssigen Zustande I. (pp. 229-245).

Band liii. Heft 4. *Annalen der Physik und Chemie* (*Wiedemann*). (15th Oct., 1894.)

Quincke, G., Ueber freiwellige Bildung von hohlen Blasen, Schaum und Myelinformen durch ölsäure Alkalien und verwandte Erscheinungen, besonders des Protoplasmas (pp. 593-633). *Volkmann, P.*, Ueber die Messung der Oberflächenspannung des Wassers in Capillarröhren aus verschiedenen Gläsern (pp. 633-664). *Volkmann, P.*, Bemerkungen zu meinen beiden Arbeiten über Capillarität aus den Jahren 1880 und 1882 (pp. 664-667).

Band ccxxxii. Heft 6. *Archiv der Pharmacie.* (22nd October, 1894.)

Schmidt, E., Ueber das Scopolamin II. (pp. 400-437). *Schneegans, A.*, und *Gerock, J. E.*, Ueber Gaultherin, ein neues Glykosid aus Betula lenta L. (pp. 437-444). *Plugge, P. C.*, Ueber die Identität von Sophorin und Cytisin (pp. 444-460). *Fischer, B.*, und *Grützner, B.*, Zur Kenntniss der Wismutsalze (pp. 460-466). *Kunz-Krause, H.*, Beiträge zur Kenntniss des Emetins (pp. 466-482). *Spirgatis, H.*, Ueber das Scammoniumharz (pp. 482-486). *Partheil, A.*, Ueber die Identität von Cytisin und Ulexin (pp. 486-488).

Jahrgang xxvii. No. 15. *Berichte der Deutschen Chemischen Gesellschaft.* (29th October, 1894.)

Fittig, R., Ueber ungesättigte Säuren (pp. 2658-2684). *Curtius T.*, und *Heidenreich, K.*, Stickstoffkohlenoxyd und Diharnstoff (pp. 2684-2686). *Michael, H. A.*, Zur Constitution des Phloretins (pp. 2686-2689). *Methner, T.*, Ueber die Einwirkung von Formaldehyd auf Chinaldin (pp. 2689-2694). *Zengelis, C.*, Ueber Tetra-hydronaphtalsäure (pp. 2694-2696). *Schall, C.*, Zur Raumisomerie der Carbodiphenyl- und Ditolylimide (pp. 2696-2700). *Jacobson, P.*, und *Piepenbrink, P.*, Untersuchungen über Reductionsproducte von Azoverbindungen V. (pp. 2700-2714). *Schär, Ed.*, Bermerkungen über unterschweflige (hydroschweflige) Säure (pp. 2714-2722). *De Chalmot, G.*, Die Bildung der Pentosane in den Pflanzen (pp. 2722-2726). *Lossen, C.*, Kurze Mittheilung über ein neues Verfahren, goldführende Erze mit Brom zu behandeln unter Regeneration des angewandten Broms (pp. 2726-2727). *Cohn, R.*, Zur Kenntniss des bei der Pancreasverdauung entstehenden Leucins (pp. 2727-2732). *Mencki, M.*, Ueber das Verhalten der aromatischen Oxyketone im Thierkörper (pp. 2732-2737). *Mencki, M.*, Ueber die Stellung der Seitenketten in den Ketonen aus Pyrogallol (pp. 2737-2738). *Gabriel, S.*, Zur Darstellung des Phenylnitromethans (pp. 2738-2739). *Schmidt, F. W.*, Ueber ein weisses, in Ammoncarbonat lösliches Zinnsulfid (pp. 2739-2743). *Ruhemann, S.*, und *Morrell, R. S.*, Ueber den Aminoäthylendicarbon säureester (pp. 2743-2748). *Christomanos, A. C.*, Ueber einen neuen Kohlensäurebestimmung-Apparat (pp. 2748-2751). *Anschütz, R.*, und *Posth, W.*, Ueber zwei cyclische Ester des Brenzcatechins (pp. 2751-2753). *Zincke, T.*, und *Schmidt, M.*, Ueber die Halogen- additionsproduct von α- und β-Naphtochinon (pp. 2753-2762). *Siegfried, M.*, Ueber Fleischsäure (pp. 2762-2764). *Meyer, Lothar*, Ueber Acetylen, eine Warnung (pp. 2764-2766). *Meyer, Lothar*, Ueber die Darstellung der Paraffine (pp. 2766-2767). *Meyer, Lothar*, Die niederen Paraffine, Aethan und Propan (pp. 2767-2769). *Meyer, Lothar*, Ein Trockenschränkchen aus Aluminium (pp. 2769-2770). *Meyer, Lothar*, und *Seubert, K.*, Ueber das Verhältniss der Atomgewichte des Wasserstoffs und Sauerstoffs (pp. 2770-2773). *Fischer, O.*, Zur Kenntniss der Orthodiamine III. (pp. 2773-2782). *Fischer, O.*, und *Jonas, O.*, Beitrag zur Oxydation, der aromatischen Orthodiamine und Orthoamidophenole (pp. 2782-2786). *Fischer, O.*, und *Schmidt, H.*, Notiz über Orthoamidodiphenylmethan (pp. 2786-2790). *Fischer, O.*, und *Hepp, E.*, Ueber Fluoresceïnanilid II. (pp. 2790-2793). *Albert, R.*, Ueber Phenolphta-

leïnanhydrid und Galleïnanilid (pp. 2793-2795). *Goldschmidt, C.*, Isochinolinsynthese (p. 2795). *Auwers, K.*, und *Haymann, K.*, Ueber das Verhalten der Natriumsalze von Phenolengegen Mono- und Dichloressigester (pp. 2795-2806). *Stein, O.*, Ueber das p-Diamidodiphenylmethansulfon (pp. 2806-2807). *Hofmann, K. A.*, Das Thioanilin von Merz und Weith mit dem Schmelzpunkt 105° und ein neues Isomeres (pp. 2807-2816). *Scholl, R.*, Ueber Formylchloridoxim, das erste Einwirkungsproduct von Salzsäure auf Fulminate (pp. 2816-2823). *Einhorn, A.*, und *Willstälter, R.*, Ueber die isomeren p-Methylendihydrobenzoësäuren (pp. 2823-2829). *Einhorn, A.*, und *Meyenberg, A.*, Ueber die Reduction der p-Dimethylamidobenzoësäure und der p-amidobenzoësäure (pp. 2829-2834). *Töhl, A.*, und *Schultz, K.*, Ueber die Einwirkung von Schwefelsäure auf Bromthiophene (pp. 2834-2840). *Schöpff, M.*, Ueber Dihydrophenonaphtacridin und Phenonaphtacridin (pp. 2840-2846). *Werner, A.*, Ueber Hydroximsäurechloride und ihre Umwandlungsproducte (pp. 2846-2850). *Ciamician, G.*, und *Silber, P.*, Ueber die Alkaloïde der Granatwurzelrinde (pp. 2850-2861). *Pinner, A.*, Ueber Nicotin (pp. 2861-2869).

Band xv. Heft 7. *Monatshefte für Chemie und verwandte Thiele anderer Wissenschaften.* (30th August, 1894.)

Kratschmer, F., und *Wiener, E.*, Grundzüge einer neuen Bestimmungsmethode der Kohlensäure in der Luft (pp. 429-433). *Skraup, Zd. H.*, Ueber die Constitution der Verbindungen von China-alkaloiden mit Äthyljodid (pp. 433-437). *Gregor, G.*, Ueber die Einwirkung von Jodmethyl auf Resacetophenonkalium (pp. 437-446). *Pum, C.*, Ueber das Verhalten von Hydrojodcinchonin zu Wasser (pp. 446-453). *Wenzel, F.*, Synthese des Kynurins (pp. 453-469). *Pollak, F.*, Studien ueber die synthetische Bildung von Mesoweinsäure und Traubensäure (pp. 469-488).

Band xv. Heft 8. (30th September, 1894.)

Neumann, G., Mangantrichlorid und Chlorokupfersäuren (pp. 489-495). *Neumann, G.*, Quantitative Analyse von Schwermetallen durch Titriren mit Natriumsulfid (pp. 495-505). *Bamberger, M.*, Zur Kenntniss der Ueberwallungsharze II. (pp. 505-519). *Bryk, E.*, Ueber die Einwirkung von Iod und Kalilauge auf Harnsäure (pp. 519-530). *Nalterer, K.*, Chemische Untersuchungen im östlichen Mittelmeer IV. Reise S. M. Schiff, "Pola" im Jahre 1893 (pp. 530-595).

Band vii. Heft 5. *Zeitschrift für Anorganische Chemie.* (30th Oct., 1894.)

Jörgensen, S. M., Zur Konstitution der Kobalt-, Chrom-, und Rhodium-basen (pp. 289-331). *Walden, P. T.*, Ueber die Doppelchloride und-bromide von Cäsium, Rutidium, Kalium, und Ammonium mit dreiwertigein Eisen, sorvie Beschreibung zweier Ferro-Ferridoppelbromide (pp. 331-339). *Schneider, E. A.*, Zur Kenntnis des Kolloïdalen Silbers (pp. 339-341). *Carey, Lea*, Ueber Lösungen von metallischen Silber (pp. 341-343). *Scholtländer, P.*, Ueber Triammoniumorthophosphat und den qualitativen Nachweis des Magnesium (pp. 343-345). *Locke, J.*, Ueber Thoriummetaoxyd und dessen Hydrate (pp. 345-351). *Fleck, H.*, und *Smith, E. F.*, Ueber Molybdänamide (pp. 351-358). *Schneider, E. A.*, Einwirkung des Phosphortrichlorid auf Magnesiumnitrid (pp. 358-359).

Band xx. Heft 1 und 2. *Zeitschrift für Physiologische Chemie.* (18th Oct., 1894.)

Cohn, H., Ueber Cacas als Nahrungsmittel (pp. 1-28). *Moraczewski, W. V.*, Ueber den Phosphorgehalt der Verdauungsproducte des Caseïns (pp. 28-52). *Lieblein, V.*, Ueber die Bestimmung der Acidität des Harnes (pp. 52-89). *Lilienfeld, L.*, Ueber Blutgerinnung (pp. 89-166). *Kutusow, L.*, Ueber die Anwendung der Colorimetrie zur quantitativen Bestimmung der Pikrinsäure in ihren Verbindungen mit organischen Basen (pp. 166-170). *Krüger, M.*, Das Verhalten von Harnsäure, Adenin und Hypoxanthin zu Kupfersulfat und Natriumsulfat, resp. Natrium thiosulfat (pp. 170-176). *Krüger, M.*, und *Wulff, C.*, Ueber eine Methode zur quantitativen Bestimmung der sog Xanthinkörper im Harne (pp. 176-186). *Hedin, S. G.*, Ueber ein neues spaltungsproduct der Hornsubstanz (pp. 186-193). *Bodtker, E.*, Ueber die Bestimmung des Chlors im Harn (pp. 193-203). *Cohn, R.*, Zur Kenntniss des bei Pancreasverdaaung entstehenden Leucins (pp. 203-210). *Cohn, R.*, Ueber das Verhalten einiger Chinolinderivate in thierischen Organismus (pp. 210-219). *Baumann, E.*, und *Fränkel, S.*, Ueber die Synthese der Homogentisensäure (pp. 219-225). *Schulze, E.*, Ueber die Bestimmung des Lecithingehalts der Pflanzensamen (pp. 225-232).

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN NOVEMBER, 1894.

Vol. xlviii. No. 288. *American Journal of Science.* (December, 1894.)

Barus, C., Remarks on Colloidal Silver (pp. 451-455).

Vol. xvi. No. 7. *American Chemical Journal.* (November, 1894.)

Morse, H. N., and *Blalock, T. L.*, Instruments for the Graduation and Calibration of Volumetric Apparatus (pp. 479-488). *Michaud, G.*, Note on the Influence of certain Metals on the Stability of the Amalgam of Ammonium (pp. 488-490). *Hertz, C. H.*, Mixed Double Halides of Antimony and Potassium (pp. 490-500). *Moyes, W. A.*, Camphoric Acid (pp. 500-511). *Noyes, A. A.*, and *Clement, A. A.*, The Electrolytic Reduction of Paranitrobenzoic Acid in Sulphuric Acid Solution (pp. 511-513). *Lyman, J. A.*, Phthaleïns of Ortho-sulpho-para-toluic Acid (pp. 513-528). *Gilpin, J. E.*, Orcin-sulphon-phthaleïn (pp. 528-530). *Ullmann, H. M.*, On Para-chlor-meta-sulpho-benzoic Acid and some of its Derivatives (pp. 530-544). *Mabery, C. F.*, On the Determination of Sulphur in Volatile Organic Compounds (pp. 544-551).

Vol. xvi. No. 12. *Journal of the American Chemical Society.* (Dec., 1894.)

Kilgore, B. W., The Determination of Phosphoric Acid by the Molybdate-Magnesia Method (pp. 793-795). *Garrigues, W. E.*, On the Gunning Method for Total Nitrogen in Fertilisers (pp. 795-799). *Davoll, D. L.*, Fallacies of Post-Mortem Tests for Morphine (pp. 799-808). *Horton, H. E.*, Fermentation of Glucose Syrups (pp. 808-809). *Linton, L. A.*, On the Technical Analysis of Asphaltum (pp. 809-822). *Hibbs, J. G.*, and *Smith, E. F.*, Action of Metallic Magnesium upon Manganous Salts (pp. 822-824). *Mason, W. P.*, and *Bowman, J. W.*, Note on the Test for Strychnine (pp. 824-825). *Garrigues, W. E.*, The Determination of Melting-Points and the Composition of some Candle Material (pp. 825-833). *Keller, H. F.*, Some Recent Contributions to our Knowledge of Metallic Reducing Agents (pp. 833-844). *Long, J. H.*, Observations on American Oil of Turpentine (pp. 844-847). *De Laire, G.*, and *Tiemann, F.*, Iridin, the Glucoside of Iris Root (pp. 847-860). *Versin, E.*, Botrytes Bassiana and its Crystalline Products (pp. 860-867). *Préscott, A. B.*, Closing Address delivered before the World's Congress of Chemists, 1893 (pp. 867-868). *Schnanche, H. G.*, Hydrogen Sulphide Generators (p. 868). *Carr, O.*, Modification of Know's Extraction Apparatus (pp. 868-869). *Waller, E.*, Laboratory Devices (pp. 869-873).

Vol. xiii. No. 11. *Journal of the Society of Chemical Industry.* (30th Nov., 1894.)

Wright, C. R. A., The Composition and Constitution of Certain Alloys (pp. 1014-1020). *Reid, W. F.*, Note on Oxidised Linseed Oil (pp. 1020-1024). *Morgan, J. J.*, Tabular Scheme for Iron Ore Analysis (p. 1025). *Lunge, G.*, Practical Results of the Lunge-Rohrmann Plate-Towers for Condensing Hydrochloric Acid (pp. 1034-1038).

Vol. xxxviii. No. 235. *Philosophical Magazine and Journal of Science.* (December, 1894.)

Ewan, T., On the Rate of Oxidation of Phosphorus, Sulphur and Aldehyde (pp. 505-537). *Young, S.*, The Influence of the Relative Volumes of Liquid and Vapour on the Vapour-Pressure of a Liquid at Constant Temperature (pp. 569-573).

Tome iii. *Annales de Chimie et de Physique.* (December, 1894.)

Freundler, P., Sur les variations du pouvoir rotatoire dans la série tartrique et le pouvoir rotatoire des corps dissons (pp. 438-524). *Chabrié, C.*, Recherches sur les transformations chimiques de la substance fondamentale du cartilage pendant l'ossification normale (pp. 524-563). *Meslin, G.*, Sur des franges d'interférences semi-circulaires (pp. 563-575).

Tomes xi.-xii. Nos. 20-21. *Bulletin de la Société Chimique de Paris.* (5th Nov., 1894.)

Moissan, H., Action de l'arc électrique sur le diamant, le bore amorphe et le silicium cristallisé

(pp. 993-995). *Moissan, H.*, Préparation et propriétés du siliciure de carbone cristallisé (pp. 995-998). *Moissan, H.*, Préparation et propriétés du borure de carbone (pp. 998-1002). *Moissan, H.*, Préparation au four électrique d'un carbure de calcium cristallise; propriétés de ce nouveau corps (pp. 1002-1007). *Moissan, H.*, Étude des acétylures cristallisés de baryum et de strontium (pp. 1007-1010). *Moissan, H.*, Préparation d'un carbure d'aluminium cristallisé (pp. 1010-1014). *Moissan, H.*, Nouvelles recherches sur le chrome (pp. 1014-1020). *Moissan, H.*, Détermination de la densité de la magnésie fondue (pp. 1020-1021). *Moissan, H.*, Impuretés de l'aluminium industriel (pp. 1021-1024). *Denigès, G.*, Sur la réaction bromhydrique des sels de cuivre (pp. 1024-1027). *Friedel, C.*, Sur une nouvelle série de matières colorantes (pp. 1027-1038). *Lumière frères* et *Seyewetz, A.*, Sur la réduction des dérivés nitres aromatiques en liqueur neutre, et la formation des hydroxylamines aromatiques (pp. 1038-1045). *Reychler, A.*, Étude sur l'essence de Cananga (pp. 1045-1052).

Tomes xi.-xii. No. 22. (20th November, 1894.)

Friedel, C., Sur une nouvelle série de sulfophosphures, les thiohypophosphates (pp. 1057-1066). *Moureu, C.*, Action du chlorure de thionyle sur les acides oxalique et formique (pp. 1066-1067). *Moureu, C.*, Action du chlorure de thionyle sur les aldoximes. Formation de nitriles (pp. 1067-1068). *Moureu, C.*, Mode de formation de la cyanamide (pp. 1068-1070). *Varet, R.*, Recherches sur le picrate mercurique (pp. 1070-1072). *Varet, R.*, Action de l'acide picrique et des picrates sur les cyanures métalliques. Les isopurpurates (pp. 1072-1073). *Muller, J. A.*, Sur le dosage de la mannite dans les vins (pp. 1073-1080). *Chabrié, C.*, Sur la synthèse des composés aromatiques sélénies (pp. 1080-1083). *Bénazet, P.*, Sur le dosage du phosphore dans les produits de la métallurgie du fer (pp. 1083-1092).

Tomes xi.-xii. No. 23. (5th December, 1894.)

Guye, P., Pouvoirs rotatoires d'éthers isomères dans la série amylique (pp. 1110-1112). *Athanasesco*, Recherches sur les nitrates basiques (pp. 1112-1115). *Lepierre, C.*, Étude des chromates de fer (pp. 1115-1129). *Bayrac, P. H.*, Méthode de préparation des paraquinones au moyen des indophénols (pp. 1129-1130). *Bayrac, P. H.*, Sur une nouvelle quinone: l'éthylbenzoquinone (pp. 1130-1131). *Bayrac, P. H.*, Sur une série d'indophénols. Méthode générale de préparation (pp. 1131-1136). *Prud'homme, M.*, Essai sur la constitution de la céruléine (pp. 1136-1138). *Lepierre, C.*, Sur le chlorhydrosulfate de quinine (pp. 1138-1139). *Bayrac, P. H.*, Sur le dosage de l'azote total urinaire par le procédé Henninger (pp. 1139-1142).

Tome cxix. No. 19. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (5th November, 1894.)

Moissan, H., Sur la vaporisation du carbone (pp. 776-782). *Berthelot*, Nouvelles observations sur les mentirs des bois de Mendon (pp. 782-783). *Ponsot, A.*, Relation entre les tensions de vapeur d'un corps à l'état solide et à l'état liquide. Influence de la pression sur la température de fusion (pp. 791-794). *Varet, R.*, Recherches sur les azotates mercuriques (pp. 797-799). *Béhal, A.*, Sur les acides campholéniques et les campholénamides (pp. 799-802). *Bourquelot, E.*, Sur la présence de l'éther methylsalicylique dans quelques plantes indigènes (pp. 802-804).

Tome cxix. No. 20. (12th November, 1894.)

Cailletet, L., et *Collardeau, E.*, Recherches sur la condensation des gaz de l'electrolyse par les corps poreux et en particulier par les métaux de la famille du platine. Application à la pile à gaz. Accumulateurs électriques sous pression (pp. 830-835). *Mathias, E.*, Détermination expérimentale directe de la chaleur spécifique de vapeur saturée et de la chaleur de vaporisation interne (pp. 849-852). *Guye, P. A.*, Détermination du poids moléculaire des liquides (pp. 852-855). *Well, J.*, Sur l'acide amylacétique actif et quelques-uns de ses dérivés (pp. 855-858). *Béhal, A.*, Sur les campholènes et sur la constitution du camphre (pp. 858-862). *Gaud, F.*, Recherches sur l'oxydation des alcools par la liqueur de Fehling (pp. 862-863).

Tome cxix. No. 22. (26th November, 1894.)

Gaud, F., Sur le passage de l'acide propionique à l'acide lactique (pp. 905-906). *Guye, P. A.*, et *Chavanne, L.*, Sur les éthers sels dérivés de l'alcool amylique actif (pp. 906-909).

Lescoeur, H., Sur le chlore, dit *organique*, de la sécrétion gastrique (pp. 909-912). *Griffiths, A. B.*, Sur la composition du pigment rouge de *Diemyctylus viridescens*, Rafinesque (pp. 912-913). *Balland* et *Maljean*, Sur les cuirs acidés (pp. 913-915).

Tome cxix. No. 23. (3rd December, 1894.)

Moissan, H., Réduction de l'alumine par le charbon (pp. 935-938). *Mailfert*, Sur la solubilité de l'ozone (pp. 951-953). *Guye, P. A.*, et *Gaulier*, Superposition des effets optiques des divers carbones asymétriques dans une même molécule active (pp. 953-955). *Pictet, R.*, Recherches expérimentales sur le point de cristallisation de quelques substances organiques (pp. 955-957).

Tome xxx. No. 10. *Journal de Pharmacie et de Chimie.* (15th November, 1894.)

Bourquelot, Sur la présence de l'éther méthylsalicylique dans quelques plantes indigènes (pp. 433-437).

Tome xxx. No. 11. (1st December, 1894.)

Gondoin, Sur un procédé de dosage de l'acide sulfocyanique (pp. 481-484). *Clárency*, Procédés optiques pou le dosage de l'albumine et de l'acide urique dans le urines (pp. 484-487). *Balland*, Essai des galons de laine, d'argent et d'or en usage dans l'armée (pp. 487-491).

Tome xxvi. No. 7. *Journal de la Société Physico-chimique Russe.*

Wagner, G., Sur la structure des terpènes et des combinaisons congénères (pp. 327-363). *Kurnakoff, W.*, Sur l'influence de l'hydratation sur la solubilité (pp. 363-375). *Kijner, N.*, Sur la structure de l'hexahydrobenzol (pp. 375-380). *Konovaloff, M.*, Sur la nitration des hydrocarbures non saturés par l'acide nitrique dilué (pp. 380-384).

Band cclxxxii. Heft 3. *Justus Liebig's Annalen der Chemie.* (2nd Nov., 1894.)

Freund, M., und *Fauvet, C.*, Untersuchungen über das Vellosin, ein Alkaloïd aus der Pereirorinde (pp. 247-267). *Reitzenstein, F.*, Ueber die Einwirkung reducirender Mittel auf Metallcyanide und einige Metallsalze mit organischen Basen (pp. 267-280). *Stobbe, H.*, Eine neue Synthese ungesattigter Dicarbonsäuren aus Ketonen und Bernsteinsäureester (pp. 280-320). *Waga, F.*, Ueber Magnesium di-phenyl (pp. 320-334). *Fittig, R.*, Condensation von Aldehyden mit der Glutarsäure (pp. 334-338). *Roedel, S.*, Benzaldehyd und Glutarsäure (pp. 338-344). *Bronnert, E.*, Isovaleraldehyd und Glutersäure (pp. 344-363). *Roser, W.*, Zur Constitution de Chinolinammoniumbasen. II. und III. (pp. 363-385).

Jahrgang xxvii. No. 16. *Berichte der Deutschen Chemischen Gesellschaft.* (12th November, 1894.)

Landolt, H., Methode zur Bestimmung der Rotations-dispersion mit Hülfe von Strahlerfiltern (pp. 2872-2887). *Möhlau, R.*, und *Koch, P.*, Zur Kenntniss der Fluoresceïnstoffe (pp. 2887-2897). *Busch, M.*, Ueber o-Amidobenzylhydrazine. Synthese von siebengliedrigen Stickstoffkohlenstoffringen (pp. 2897-2904). *Cohn, R.*, Ueber das Verhalten einiger Pyridin-, Naphtalin- und Chinolinderivate im thierischen Organismus (pp. 2904-2919). *Eberhard, O.*, Ueber das α α-Dithienyl (pp. 2919-2920). *V. Pechmann, H.*, und *Runge, P.*, Oxydation der Formazylverbindungen (pp. 2920-2930). *Bamberger, E.*, Ueber die stereomeren benzoldiazosulfonsauren Salze (pp. 2930-2939). *Bischoff, C. A.*, und *Walden, P.*, Ueber die Aethylenester der Glycol- und Oxalsäure und die Anhydride α-halogenisirter Fettsäuren (pp. 2939-2952). *Ladenburg, A.*, Ueber das Methylglyoxalidin oder Lysidin (pp. 2952-2958). *Ladenburg, A.*, und *Scholtz, M.*, Synthese der Piperinsäure und des Piperins (pp. 2958-2960). *Einhorn, A.*, Ueber die technische Darstellung des Cocäins aus seinen Nebenalkaloiden (pp. 2960-2961). *Freund, M.*, Untersuchungen über das Thebäin (pp. 2961-2964). *Widman, O.*, Ueber das α-Acetphenylhydrazid (pp. 2964-2966). *Hantzsch, A.*, und *Freese, H.*, Weiteres über den Schwefelgehalt und die Chlorkalkreaction des Anilins und Paramidophenols (pp. 2966-2968). *Hantzsch, A.*, und *Freese, H.*, Zur Bildung von Farbstoffen aus stereoisomeren Diazoverbindungen und zur Configuration von Diazoäthern (pp. 2968-2975). *Heffter, A.*, Ueber zwei Cacteenalkaloïde (pp. 2975-2979). *Schunck, E.*, und *Marchlewski, L.*, Zur Kenntniss der Carminsäure (pp. 2979-2985). *Fischer, E.*, Einfluss der Configuration auf die Wirkung der Enzyme (pp. 2985-2993). *Henriques, R.*, Ueber Thioderivate des β-Naphtols (pp. 2993-3005). *Michaelis, A.*, und *Luxembourg, K.*, Ueber die angebliche Nichtexistenz des Isopro-

pylenamidophenlos (pp. 3005-3009). *Liebermann, C.*, und *Michaelis, P.*, Analysen alizaringefäsbter Baumwollstoffe (pp. 3009-3019). *Klages, A.*, und *Knoevenagel, E.*, Synthese von m-Chlortoluol und s-Chlorxylol mettels Acetessigeste (pp. 3019-3025).

Jahrgang xxvii. No. 17. (26th November, 1894.)

Dühring, U., Zur Wahrung der Allgemeingültigkeit des Gesetzes der correspondirenden Siedetemperaturen gegenüber den Hrn Kahlbaum und v. Wirkner (pp. 3028-3035). *Besthorn, F.*, *Banzhaf, E.*, und *Jaeglé, G.*, Ueber das γ-Ortho-Oxyphenylchinolin und das γ-Meta-Oxyphenylchinolin (pp. 3035-3043). *Walter, G.*, Notiz über eine polymere Form des Oxäthylsulfonäthylensulfinsäurelactons (pp. 3043-3045). *Walter, G.*, Ueber einige Abkömmlinge des Oxäthylmethylsulfons (pp. 3045-3050). *Böniger, M.*, Ueber 1. 2-Amidonaphtolsulfosäuren (pp. 3050-3055). *Otto, R.*, Zur Kenntniss der Bildungsweisen und des chemischen Verhaltens des Vinyltriphenylsulfons (Triphenylsulfonmethan) (pp. 3055-3059). *Lovén, J. M.*, Darstellung der Thiodiglycolsäure (pp. 3059-3061). *Bolam, H. W.*, Zur Verseifung des Dicarboxylglutaconsäureesters (pp. 3061-3062). *Ladenburg, A.*, Ueber reines a-Coniin. II. (pp. 3062-3066). *Graebe, G.*, Ueber Nomenclatur ringförmiger Naphtalinderivate (pp. 3066-3068). *Lagodzinski, K.*, und *Hardine, D.*, Ueber 1. 2-Dioxynapht, 3. 4-acridon (pp. 3068-3075). *Lagodzinski, K.*, und *Hardine, D.*, Ueber die Darstellung des 1. 2-Naphtochinons (pp. 3075-3077). *Ciamician, G.*, Ueber die Eigenschaften zweifach hydrirter Chinoline und die Constitution stickstoffhalbger Ringsysteme (pp. 3077-3082). *Techow, W.*, Ueber die Verwandlungen des Dimethylalloxans (pp. 3082-3089). *Cramer, L.*, Ueber einige Derivate des Caffeïns (pp. 3089-3093). *Löb, W.*, Ueber die Einwirkung von Aminoacetal auf o- und p-Nitrobenzoylchlorid (pp. 3093-3097). *Heller, H.*, Ueber einige Derivate des Aminoaldehyds (pp. 3097-3102). *Alexander, W.*, Ueber die Phtalylverbindungen des Aminoacetals (pp. 3102-3105). *Müller, H.*, Ueber p-Hydrazinodiphenyl (pp. 3105-3109). *Kopisch, F.*, Ueber einige Oxyderivate der Phenylbuttersäure (pp. 3109-3113). *Winterstein, E.*, Ueber ein stickstoffhaltiges Spaltungsproduct der Pilzcellulose (pp. 3113-3115). *Kiliani, H.*, und *Bazlen, M.*, Ueber Maltol (pp. 3115-3121). *Goldsobel, A. G.*, Zur Constitution der Ricinölsäure und Ricinstearolsäure (pp. 3121-3129). *Meyer, V.*, *Riddle, W.*, und *Lamb T.*, Verfahren zur Bestimmung von Schmelzpunkten bei Glühhitze (pp. 3129-3143). *Meyer, V.*, *Riddle, W.*, und *Lamb, T.*, Der Molecularzustand des Calomeldampfes (pp. 3143-3146). *Meyer, V.*, und *Sudborough, J. J.*, Weiteres über die Esterbildung aromatischer Säuren (pp. 3146-3153). *Meyer, V.*, und *Sudborough, J. J.*, Ueber einige mehrfach nitrirte aromatische Körper (pp. 3153-3160). *Meyer, V.*, und *Sudborough, J. J.*, Ueber die Entstehung von Dicarboniden aus Schwefelkohlenstoff bei neiderer Temperatur (pp. 3160-3161). *Pinnow, J.*, Ueber Tetramethyldiamidodiphenylmethan (pp. 3161-3168). *Hantzsch, A.*, Ueber die Ursache der Umlagerung von α-Bromacetessigäther in γ-Bromacetessigäther (pp. 3168-3169).

Band l. Nos. 21-22. *Journal für praktische Chemie.* (1st November, 1894.)

Stohmann, F., und *Schmidt, R.*, Ueber den Wärmewerth des Glycogins (pp. 385-388). *Stohmann, F.*, und *Langbein, H.*, Ueber den Wärmewerth isomerer Säuren von der Zusammensetzung $C_6H_7O_3$ und $C_7H_6O_3$ (pp. 388-401). *Finckh, J.*, und *Schwimmer, M.*, Ueber Abkömmlinge des Aurins (pp. 401-446). *Troeger, J.*, Weitere Beiträge zur Kenntniss der Reductionsproducte des starren α-Dichloreyanäthyls (pp. 446-461). *Schneider, R.*, Ueber das Atomgewichte des Wismuths (pp. 461-472). *Hesse, A.*, Reuniol, ein neuer Terpenalkohol (pp. 472-479). *Deninger, A.*, Ueber Darstellung von Benzoësäureanhydrid (pp. 479-480).

Band xv. Heft 2. *Zeitschrift für Physikalische Chemie.* (6th November, 1894.)

Roozeboom, H. W. B., Graphische Darstellung der heterogenen Systeme aus ein bis vier Stoffen, mit Einschluss der chemischen Umsetzung (pp. 145-159). *Wakeman, A. J.*, Ueber die Beeinflussung der Molekular-Leitfähighkeit der Essigsäure durch kleine Mengen anderer elektrolytischer Substanzen. Anwendung der Theorie der isohydrischen Lösungen (pp. 159-183). *Behrend, R.*, Ueber die Löslichkeit der Doppelverbindungen. III. (pp. 183-196). *Walden, P.*, Ueber die optische Drehung der Ionen (pp. 196-209). *Abegg, R.*, Studien über Gefrierpunkte Konzentrierter Lösungen (pp. 209-262). *Wesendonck, K.*, Ueber den Kritischen Zustand (pp. 262-267). *Roszkowski, J.*, Studien über die Kathodische Polarisation. I. Verlauf und Grösse der galvanischen Polarisation bei

festen Kathoden (pp. 267-305). *Roszkowski, J.*, Studien über die Kathodische Polarisation. II. Verlauf und Grösse der galvanischen Polarisation bei flüssigen Kathoden (pp. 305-323). *Bandrowski, E.*, Ueber Lechterscheinungen während der Krystallisation (pp. 323-327).

Band xv. Heft 3. (30th November, 1894.)

Wildermann, M., Der experimentelle Beweis der van't Hoffschen Konstante, des Arrheniusschen Salzes, des Ostwaldschen Verdünnungsgesetzes in sehr verdünnten Lösungen (pp. 337-358). *Wildermann, M.*, Zur Bestimmung des Gefrierpunktes des Wassers (pp. 358-365). *Lewis, P. B.*, Methode zur Bestimmung der Gefrierpunkte von sehr verdünnten Lösungen (pp. 365-386). *Pietet, R.*, und *Altschul, M.*, Ueber das Verhalten der Phosphoreszenzerscheinungen bei sehr tiefen Temperaturen (pp. 386-389). *Löwenherz, R.*, Ueber die Verseifungsgeschwindigkeit einiger Oster (pp. 389-399). *Ostwald, W.*, Das Chemometer (pp. 399-409). *Ostwald, W.*, Die wissenschaftliche Elektrochemie der Gegenwart und die technische der Zukunft (pp. 409-422). *Berghoff, V.*, Bestimmung der Brechungsexponenten von Schwefel- und Phosphorlösungen in Schwefelkohlenstoff nach der Prismenmethode mit Fernsohr und Skala (pp. 422-437). *Verschaffelt, J.*, Die Lösungstension als Hilfsmittel für die Bestimmung von Umwandlungstemperaturen (pp. 437-457). *Van Laar, J. J.*, Ueber die genauen Formeln für den osmotischen Druck, für die Änderungen der Löslichkeit, für Gefrierpunkts- und Siedepunkt-sänderungen, und für die Lösungs- und Verdünnungswärmen bei in Lösung dissociierten Körpern (pp. 457-498).

Anno 24. (Vol. ii.), Fascicolo 4. *Gazetta Chimica Italiana.* (31st Oct., 1894.)

Ponzio, G., Sull'isoundecilammina (pp. 277-289). *Filete, M.*, e *Babracco, G.*, Sulla costituzione dell'acido ossibeenico (chetobeenico) (pp. 289-290). *Filete, M.*, e *Ponzio, G.*, Sull 2, 3-undecadione (pp. 290-299). *Ciamician, G.*, e *Boeris, G.*, II. Sulla costituzione delle idrochinoline, considerazioni ed esperienze intorno alla struttura dei nuclei azotate (pp. 299-310). *Prati, U.*, Sulla formazione delle ossime (pp. 310-317). *Angeli, A.*, Sull'azione dell'acido nitroso sopra l'amminocanfora (pp. 317-325). *Paternò, E.*, e *Crosa, F.*, Ricerche sulla sordidina (pp. 325-336). *Errera, G.*, Recherche nel gruppo della canfora. V. Azione della idrossilamina sull'anidride canforica (pp. 336-348). *Errera, G.*, Recherche nel gruppo della canfora. VI. Azione dell'ipobromito potassico sulla amide canforica (pp. 348-350). *Ciamician, G.*, e *Silber, P.*, II. Recherche sugli alcaloidi del melagrano. Sui derivati della granatonina (pp. 350-366). *Angeli, A.*, Azione dell'acido nitroso sopra l'amminouracile e sopro l'amminoacetone.

ENUMERATION OF TITLES OF CHEMICAL PAPERS APPEARING IN DECEMBER, 1894.

Vol. xlix. No. 289. *American Journal of Science.* (January, 1895.)

Pupin, M. I., Automatic Mercury Vacuum Pump (pp. 19-21). *Linebarger, C. E.*, Application of the Schroeder-Le Chatelier Law of Solubility to Solutions of Salts in Organic Liquids (pp. 48-53).

Vol. xvi. No. 8. *American Chemical Journal.* (December, 1894.)

Weems, J. B., On Electrosyntheses by the Direct Union of Anions of Weak Organic Acids (pp. 569-589). *De Chalmot, G.*, Pentosans in Plants (pp. 589-611). *Trevor, J. E.*, and *Kortright, F. S.*, On Chemical Equilibria as Temperature-Functions (pp. 611-625). *Edwards, W. F.*, A New Formula for Specific and Molecular Refraction (pp. 625-634). *Dains, F. B.*, and *Rothrock, I. R.*, On Paraisobutylsalicyl Aldehyde and some of its Derivatives (pp. 634-645). *Orndorff, W. R.*, and *Balcom, L. L.*, The Polymeric Modifications of Propionic Aldehyde: Parapropionic and Metapropionic Aldehydes (pp. 645-650).

Vol. xvii. No. 1. *Journal of the American Chemical Society.* (Jan., 1895.)

Spenzer, J. G., On the Behaviour of Allylmalonic, Allylacetic and Ethylidenepropionic Acids, when Boiled with Caustic Soda Solutions (pp. 1-33). *Tennille, G. F.*, The Phosphomolybdic Acid Test as Applied to Lard Analysis (pp. 33-41). *Grosvenor, J. W. M.*, Some New Solvents for Perchromic Acid (pp. 41-43). *De Roode, R.*, Some Facts Observed in the Determination of Phosphoric Acid by the Molybdic Acid Process (pp. 43-46). *De Roode, R.*, The Addition of Calcium Chloride to the Solution of a Fertiliser in the Determination of Potash (pp. 46-47). *De Roode, R.*, On the Preparation of Ammonium Citrate Solution (p. 47). *Garrigues, W. E.*, The Determination of Potash in Manures (pp. 47-51). *Horne, W. D.*, The Rapid and Accurate Analysis of Bone-Black (pp. 51-55). *Peckham, S. F.*, The Asphalt Question (pp. 55-64). *Hibbard, P. L.*, Quick Estimation of Starch (pp. 64-68). *Horton, H. E.*, Alkali and Sulphurous Acid Processes Used in the Manufacture of Starch from Corn (p. 68).

Vol. xix. No. 225. *The Analyst.* (December, 1894.)

Ashby, A., On the Detection of Methylated Spirits in Tinctures, Spirits, or other Compounds (pp. 265-273). *Cribb, C. H.*, The Need for Fuller Statistics of Adulteration (pp. 273-279).

Vol. lxv. No. 385. *Journal of the Chemical Society.* (December, 1894.)

Japp, F. R., and *Murray, T. S.*, Preparation of 2′ : 3′-Diphenylindoles from Benzoïn and Primary Benzenoid Amines (pp. 889-899). *Fenton, H. J. H.*, Oxidation of Tartaric Acid in Presence of Iron (pp. 899-911). *Brown, A. J.*, The Specific Character of the Fermentative Functions of Yeast Cells (pp. 911-923). *Perkin, A. G.*, and *Hummell, J. J.*, The Colouring Principles of Ventilago Madraspatana (pp. 923-944). *MacDonald, G. W.*, and *Masson, O.*, A Product of the Action of Nitric Oxide on Sodium Ethylate (pp. 944-950). *Perkin, jun., W. H.*, Derivatives of Tetramethylene (pp. 950-978). *Haworth, E.*, and *Perkin, jun., W. H.*, 1 : 2-Pentamethylenedicarboxylic Acid (pp. 978-987). *Crossley, A. W.*, and *Perkin, jun., W. H.*, Substituted Pimelic Acids (pp. 987-995). *Lean, B.*, Homologues of Butanetetracarboxylic Acid and of Adipic Acid (pp. 995-1024). *Lean, B.*, Note on the Affinities of Polybasic Acids (pp. 1024-1028). *Sudborough, J. J.*, Chlorination of Aniline (pp. 1028-1030). *Laurie, A. P.*, The Electromotive Force of Alloys in a Voltaic Cell (pp. 1030-1039).

Vol. lxvi. No. 386. (January, 1895.)

Lewis, P. B., A New Method of Determining the Freezing Points of very Dilute Solutions (pp. 1-17). *Dobbie, J. J.*, and *Lauder, A.*, Corydaline. Part IV. (pp. 17-25). *Dobbie, J. J.*, and *Lauder, A.*, The Alkaloids of *Corydalis Cara*-Corybulbine (pp. 25-30). *Schunck, E.*, The Yellow Colouring Matter of *Sophora japonica* (pp. 30-32). *Japp, F.*

R., and *Davidson, W. B.*, Interaction of 1 : 2-Diketones with Primary Amines of the General Formula, $R^1 CH_2 \cdot NH_2$ (pp. 32-48). *Fenton, H. J. H.*, A New Method of Obtaining Dihydroxytartaric Acid, and the Use of this Acid as a Reagent for Sodium (pp. 48-50). *Meldola, R.*, and *Streatfield, F. W.*, Isomeric Dinitro-diazoamidobenzenes and their Melting Points (pp. 50-54). *Chapman, A. C.*, Essential Oil of Hops (pp. 54-63).

Vol. xiii. No. 12. *Journal of the Society of Chemical Industry.* (31st Dec., 1894.)

Kuhn, E. W., On the Rational Sterilisation of Alimentary Liquids (pp. 1133-1138). *Christy, T.*, India-Rubber (p. 1138). *Jahn, E.*, Analgene (Ortho-Ethoxy-Ana-Mono-Benzoyl-amidoquinoline) (pp. 1138-1139). *McCombie, C.*, Phosphor Copper and Bronze (p. 1139). *Watson, E. E.*, On the Calculation and Composition of Blast Furnace Charges as Applied to the Smelting of Lead and Silver Ores (pp. 1140-1142). *Gilchrist, P. S.*, Pipe Columns for Saving Chamber Space, in the Manufacture of Sulphuric Acid (pp. 1142-1151). *Weber, C. O.*, On a New Class of Lake Pigments (pp. 1151-1154). *Richardson, F. W.*, The Bacteriological Analysis of Water. I. (pp. 1157-1160). *Mann, H. H.*, On the Action of Certain Antiseptic Substances on Yeast (pp. 1160-1164). *Mackey, W. M.*, Spontaneous Combustion of Oils Spread on Cotton. I. Effect of Free Fatty Acid (pp. 1164-1166). *Irvine, R.*, New Form of Lamp for Burning Paraffin Oil with a Smokeless Flame for Laboratory Use (p. 1167). *Mason, A. H.*, Chairman's Address (pp. 1167-1177). *Parker, C. E.*, An Apparatus for Extraction (pp. 1177-1178). *Schweitzer, H.*, and *Lungwitz, E.*, A New Reaction for the Detection of Soap in Lubricants (pp. 1178-1179).

Vol. xxxix. No. 236. *Philosophical Magazine and Journal of Science.* (January, 1895.)

Sutherland, W., Further Studies on Molecular Force (pp. 1-47). *Griffiths, E. H.*, The Influence of Temperature on the Specific Heat of Aniline (pp. 47-78). *Northrup, E. F.*, A Method for Comparing the Values of the Specific Inductive Capacity of a Substance under Slowly and Rapidly Changing Fields: Results for Paraffin and Glass (pp. 78-93). *Blanshard, C. T.*, The Rôle of Atomic Heat in the Periodic Series of the Elements (pp. 106-115). *Smithells, A.*, The Luminosity of Gases (pp. 122-134). *Hopkinson, J.*, Specific Inductive Capacities of Water, Alcohol, etc. (pp. 134-165).

Vol. lvi. No. 338. *Proceedings of the Royal Society.* (24th Nov., 1894.)

Frankland, P. F., and *Ward, M. H.*, Third Report to the Royal Society Water Research Committee (pp. 315-363).

Tome iv. *Annales de Chimie et de Physique.* (January, 1895.)

Carvallo, E., Spectres calorifiques (pp. 5-79). *Berthelot*, Le principe du travail maximum et l'entropie (pp. 79-100). *Berthelot*, Sur les gaz isomériques avec le propylène et sur leurs sulfates (pp. 100-107). *Berthelot*, Recherches sur le triméthylène et sur le propylène et sur une nouvelle classe de carbures d'hydrogène; l'isomérie dynamique (pp. 107-117). *Berthelot*, Recherches sur la phénylhydrazine. Action de l'oxygène et action de l'eau formation des sels (pp. 117-133). *Berthelot*, Sur les relations qui existent entre les chaleurs latentes de vaporisation et de fusion des corps appartenant à une même famille et sur l'intervention de ces relations dans le calcul des variations d'entropie des systèmes (pp. 133-136). *Moissan, H.*, Action d'une haute température sur les oxydes métalliques (pp. 136-144).

Tomes xi.-xii. No. 24. *Bulletin de la Société Chimique de Paris.* (20th Dec., 1894.)

Bayer, R. S., Sur un nouvel élément extrait de la bauxite rouge française (note preliminaire) (pp. 1155-1163). *Senderens, J. B.*, Sur un cas singulier de précipitation métallique (pp. 1163-1165). *Senderens, J. B.*, Sur un orthoazotate plombique (pp. 1165-1166). *Varet, R.*, Recherches sur les sulfates mercuriques (pp. 1166-1170). *Guye, A. P.*, et *Gautier*, Superposition des effets optiques des divers carbones asymétriques dans une même molécule active (pp. 1170-1178). *Welt*, Sur les hydrocarbures actifs à radicaux amyliques (pp. 1178-1185). *Causse, H.*, Nitrosalicylates de bismuth (pp. 1185-1188). *Prudhomme, M.*, Sur les matières colorantes sulfonées dérivées du triphenylméthane (pp. 1188-1190).

Tome cxix. No. 24. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (10th December, 1894.)

Moissan, H., Étude des différentes variétés de graphite (pp. 976-981). *Trubert*, Détermination des proportions de carbonate de chaux et de carbonate de magnésie dans les terres, cendres, etc. (pp. 1009-1011). *Andouard, A.*, Le phosphate du Grand-Connétable (pp. 1011-1012). *Bertrand, G.*, et *Mallière, A.*, Sur la pectase et sur la fermentation pectique (pp. 1012-1014). *Maumene, E.*, Sur un procédé nouveau pour épurer les alcools, les sucres et un certain nombre d'autres matières organiques (pp. 1014-1016).

Tome cxix. No. 26. (24th December, 1894.)

Moissan, H., Déplacement du carbone par le bore et le silicium dans la fonte en fusion (pp. 1172-1175). *Pictet, R.*, Recherches expérimentales sur le rayonnement à basses températures (pp. 1202-1206). *Peyron, J.*, Contribution à l'étude de l'ozone atmosphérique (pp. 1206-1208). *Villiers, A.*, Sur les sulfures métalliques (pp. 1208-1211). *Delépine*, Combinaisons de l'hexamethylène-amine avec l'azotate, le chlorure et le carbonate d'argent (pp. 1211-1213). *Colson, A.*, Sur les éthers cyanés (pp. 1213-1215). *Lapierre, C.*, Sur les chromates de fer (pp. 1215-1218). *Bach, A.*, Nouveau réactif permettant de démontrer la présence de l'eau oxygénée dans les plantes vertes (pp. 1218-1221). *Combes, A.*, Sur la valence du glucinium et la formule de la glucine (pp. 1221-1224). *Zorn, L.*, et *Brunel, H.*, Sur la constitution des sulfones aromatiques (pp. 1224-1226).

Tome cxix. No. 27. (31st December, 1894.)

Moissan, H., Étude des graphites du fer (pp. 1245-1250). *Villiers, A.*, Sur les sulfures de nickel et de cobalt (pp. 1263-1266). *De Forcrand*, Sur l'éthylate de calcium (pp. 1266-1268). *Jungfleisch, E.*, et *Léger, E.*, Sur l'oxycinchonine-β (pp. 1268-1270). *Brochet, A.*, Action du chlore sur les alcools secondaires (pp. 1270-1273). *Parenty, H.*, et *Grasset, E.*, Sur la préparation industrielle et les propriétés physiologiques de l'oxalate et des sels cristallisés de la nicotine (pp. 1273-1276). *Renard, A.*, Sur le goudron de pin (pp. 1276-1278).

15[e] Année. Tome i. No. 1. *Journal de Pharmacie et de Chimie.* (1st Jan., 1895.)

Riche, A., Recherches sur les alliages de l'aluminium (pp. 5-12). *Meillère*, Composition du lait de beurre (pp. 12-13). *Desgrez, A.*, Contribution à l'étude des carbures non saturés (pp. 13-17).

Band cclxxxiii. Heft 1 und 2. *Justus Liebig's Annalen der Chemie.*

Thiele, J., und *Stange, O.*, Ueber semicarbazid (pp. 1-47). *Fittig, R.*, Ueber Umlagerung bei den ungesättigten Säuren (pp. 47-66). *Spenzer, J. G.*, Umlagerung der $\beta\gamma$-Pentensäure (Aethylidenpropionsäure) (pp. 66-80). *Spenzer, J. G.*, Umlagerungversuche mit der $\gamma\delta$-Pentensäure (Allylessigsäure) (pp. 80-82). *Mackenzie, J. E.*, Ueber die Pentensäuren, welche durch Einwirkung von Propionaldehyd auf Malonsäure entstehen (pp. 82-100). *Fittig, R.*, Ueber die Krystallform der Mono- und Dibromvaleriansäuren (pp. 100-105). *Fittig, R.*, Umlagerung der Angelicasäure und Tiglinsäure (pp. 105-109). *Penschuk, M.*, Oxydation der Tiglinsäure und Angelicasäure (pp. 109-117). *Baker, C. F.*, Umlagerung der $\beta\gamma$-Hexensäure (Hydrosorbinsäure) (pp. 117-129). *Feurer, J.*, Umlagerung der $\beta\gamma$-Isoheptensäure (pp. 129-149). *Staedel, W.*, Constitution der isomeren symmetrischen Biderivate des Diphenylmethans und Benzophenons (pp. 149-151). *Staedel, W.*, Isomere Dinitrodiphenylmethane und ihre Abkömmlinge (pp. 151-164). *Staedel, W.*, Dinitro-, Diamido-, und Dioxybenzophenone (pp. 164-181). *Otto, R.*, Beiträge zur Kenntniss ungesättigter Sulfone. I. Ueber Allylphenylsulfon und Allyl-p-tolylsulfon (pp. 181-209). *Behrend, R.*, und *Tryller, H.*, Ueber die Oxydation Aliphatischer Aldehyde und Ketone durch Salpetersäure. II. (pp. 209-245). *Graebe, C.*, und *Levy, S.*, Ueber Condensation von Toluchinon und Acetessigäther (pp. 245-269).

Band cclxxxiii. Heft 3. (8th December, 1894.)

Silberstein, A., Oxydationsproducte der $\beta\gamma$- und $\alpha\beta$-Isoheptensäure (pp. 269-279). *Weil, S.*, Umlagerung der $\beta\gamma$-Isoctensäure (pp. 279-291). *De Vos*, F., Oxydationsproducte der $\beta\gamma$-und $\alpha\beta$-Isoctensäure (pp. 291-297). *Luib, A.*, Umlagerung der $\beta\gamma$-Phenylcrotonsäure (pp. 297-308). *Hoffmann, T.*, Umlagerung der Phenyl-$\beta\gamma$-pentensäure (Hydrocinnamenylacrylsäure) (pp. 308-318). *Perrin, H.*, Ueber die gebromten Säuren, welche

durch Anlagerung von Brom und Bromwasserstoff an die Cinnamenylacrylsäure, die Phenyl-$\beta\gamma$-pentensäure und die Phenyl-$\alpha\beta$-pentensäure entstehen (pp. 318-337). *Mayer, E.*, Oxydationsproducte der Phenyl-$\beta\gamma$- und Phenyl-$\alpha\beta$-pentensäure (pp. 337-341). *Zincke, T.*, und *Engelhardt, M.*, I. Ueber Dichloroxyinden-carbonsäure (pp. 341-360). *Kuster, F. W.*, II. Ueber die blaue Jodstärke und die molekulare Structur der "gelösten" Stärke (pp. 360-380). *Freer, P. C.*, Zur Kenntniss des Acetons. I. Ueber die Einwirkung von Chlorkohlensäureäthylester auf Natriumaceton (pp. 380-391).

Band liv. Heft 1. *Annalen der Physik und Chemie (Wiedemann).* (15th Dec., 1894.)

Knox, W. F., Ueber das Leitungsvermögen wässriger Lösungen der Kohlensäure (pp. 44-58). *Prytz, K.*, und *Holst, H.*, Die Absorptionscoefficienten der Kohlensäure und des Schwefelwasserstoffes in Wasser bei dessen Gefrierpunkt. Eine experimentelle untersuchung (pp. 130-139). *Zimansky, E.*, Ueber das elastische Verhalten des Zinks bei verschiedenen Temperaturen (pp. 139-164). *Vogel, H. W.*, Die farbigen Wasser der Caprenser Grotten, der Schweizer Eishöhlen und Yellowstonequellen (pp. 175-178).

Band ccxxxii. Heft 7. *Archiv der Pharmacie.* (14th December, 1894.)

Vogtherr, M., Ueber die Früchte der Randia dumetorum-Lam (pp. 480-532). *Schneegans, A.*, und *Bronnert, E.*, Ilicen, ein aus Ilex aquifolium L. dargestelter neuer Kohlenwasserstoff (pp. 532-539). *Hanausek, F. H.*, Zur Morphologie der Kaffeebohne (pp. 539-545). *Böttinger, C.*, Ueber einige Galluss-säurederivate (pp. 545-549). *Böttinger, C.*, Zur Kenntniss der Glyoxylsäure (pp. 549-557). *Plugge, P. C.*, Ueber die Identität von Cytisin und Ulexin (pp. 557-558). *Partheil, A.*, Ueber die Identität von Cytisin und Ulexin (pp. 558-559). *Oberländer, P.*, Ueber den Tolubalsam (pp. 559-568).

Band ccxxxii. Heft 8. (31st December, 1894.)

Oberländer, P., Ueber den Tolubalsam (pp. 569-601). *Paulmann, W.*, Beiträge zur Kenntniss des Sarkosins (pp. 601-639). *Power, F.*, und *Kleber, C.*, Ueber die Bestandtheile des amerikanischen Pfefferminzöles (pp. 639-648).

Jahrgang xxvii. No. 18. *Berichte der Deutschen Chemischen Gesellschaft.* (10th December, 1894.)

Traube, J., Das atomare und moleculare Lösungsvolumen (pp. 3173-3179). *Traube, J.*, Die Grundlagen eines neuen Systems der Elemente (pp. 3179-3181). *Staats, G.*, Ueber neue Fundstätten isolirter Gypskrystalle (pp. 3181-3182). *Claisen, L.*, Bemerkung zu einer Mittheilung von A. Deninger "Ueber Darstellung von Benzoësäureanhydrid (pp. 3182-3185). *Proost, W. F.*, Die Spaltung der Dihydro-o-phtalsäuren (pp. 3185-3186). *Wislicenus, W.*, Ueber den Formylbernsteinsäureester (pp. 3186-3189). *Fischer, E.*, Synthesen in der Zuckergruppe. II. (pp. 3189-3232). *Raum, W.*, Ueber eine neue Klasse cyklischer Jodverbindungen der Jodosogruppe aus Jodphenylessigsäure (pp. 3232-3235). *Radziewanowski, C.*, Beiträge zur Kenntniss der Wirkungsweise des Aluminiumchlorids (pp. 3235-3238). *Tassinari, G.*, Die Thioderivate des β-Naphtols (pp. 3238-3239). *Busch, M.*, und *Roegglen, H.*, Ueber Benzyl-o-amido-benzylanilin (pp. 3239-3247). *Buchner, E.*, Ueber am Kohlenstoff phenylirte Pyrazole (pp. 3247-3250). *Buchner, E.*, Diazoessigester und Pikrinsäure (pp. 3250-3251). *Röhmann, F.*, Zur Kenntniss der Glucase (pp. 3251-3253). *Hinsberg, O.*, und *Rosenzweig, J.*, Synthese von Indol- und Glycocollderivaten (pp. 3253-3259). *Hinsberg, O.*, und *Rosenzweig, J.*, Ueber einige Diphenylsulfonderivate (pp. 3259-3261). *Nietzki, R.*, und *Bothof, H.*, Zur Kenntniss des Thioanilins (pp. 3261-3263). *Nietzki, R.*, und *Bothof, H.*, Ueber die Chlorkalkreaction des Anilins (pp. 3263-3264). *Hantzsch, A.*, Ueber die Salze der stickoxydschwefligen Säure (pp. 3264-3273). *Pinner, A.*, und *Caro, N.*, Ueber die Einwirkung von Hydrazin auf Imidoäther (pp. 3273-3291). *Traube, W.*, Ueber Isonitramine. II. (pp. 3291-3294). *Albrecht, K.*, Zur Kenntniss der Diphenylmethanfarbstoffe (pp. 3294-3299). *Biehringer, J.*, Ueber Pyronine (pp. 3299-3305). *Olszewski, K.*, Zur Berichtigung (pp. 3305-3307). *Wolffenstein, R.*, Concentration und Destillation von Wasserstoffsuperoxyd (pp. 3307-3312).

Band l. Nos. 23-24. *Journal für praktische Chemie.* (30th November, 1894.)

Kurnakow, N., Ueber complexe Metallbasen. I. Metallverbindungen des Thiocarbamids (pp. 481-508). *Curtius, T.*, Derivate des Diamids mit geschlossener Atomgruppirung. I. (pp. 508-531). *Wirsing, F.*, Ueber das Pyrazolin und einige seiner Derivate (pp.

531-555). *Bertram, J.*, und *Walbaum, H.*, Ueber das Resedawurzelöl (pp. 555-561). *Lösner, H.*, Zwei neue Laboratoriumsapparate. (1. Rührwerk; 2. Wasserbad) (pp. 561-563). *Loesner, H.*, Ueber die Reduction Aromatischer Nitroverbindungen (pp. 563-567). *Claus, Ad.*, Die sogenannte Stereochemie des Stickstoffs und J. H. van't Hoff (pp. 567-576).

Jahrgang xxxiv. Heft 1. *Zeitschrift für Analytische Chemie.* (January, 1895.)

König, J., und *Karsch, W.*, Das Verhältniss von Dextrose zu Lävulose im Süsswein und Honig und die Benutzung desselben zum Nachweis von Verfälschungen dieser Genussmittel (pp. 1-19). *Bornträger, A.*, Ueber die Ausführung der Fehling'schen Titrirung in der Weinanalyse (pp. 19-25). *Ganlter, F.*, Eine neue Methode zur gasvolumetrischen Bestimmung des Stickstoffs in Nitraten (pp. 25-33). *Segalle, R.*, Ueber eine neue maassanalytische Bestimmung der Phosphorsäure in ihren reinen Lösungen (pp. 33-39). *Lenz, W.*, Ueber eine eigenthümliche Schwierigkeit beim Nachweis des Chlors im Methylenblau nebst anderen Mittheilungen über Methylenblau (pp. 39-49). *Stackmann, A.*, Kaukasischer Thee aus Kutais (pp. 49-51). *Jedermann, R.*, Zur Prüfung des Rosenöls auf Geranuimöl (pp. 51-54). *Holde, D.*, Ersatz-Vorrichtung für Scheidetrichter (pp. 54-55). *Vaneno, L.*, Tabelle zur Harnstoffbestimmung nach Riegler (pp. 55-58).

Band vii. Heft 6. *Zeitschrift für Anorganische Chemie.* (12th Dec., 1894.)

Spring, W., Ueber die Umwandlung des schwarzen Quecksilbersulfides in rotes und die Dichte und spezifische Wärme beider Kösper (pp. 371-384). *V. Kalecsinszky, A.*, Ueber die Aufbewahrung Chemisch reiner alkalischer Lösungen (pp. 384-386). *Schneider, E. A.*, Ueber einige Methoden zur Abschiedung der Phosphorsäures Alkali aus den Phosphaten des Kalkes und Eisenoxydes (pp. 386-392). *Kraut, K.*, Gesättigt-orthophosphorsaures Ammoniumoxyd (pp. 392-393). *Seubert, K.*, und *Rohrer, R.*, Ueber die Einwirkung von Ferriacetat auf Kaliumjodid und Jodwasserstoff (pp. 393-406). *Kehrmann, F.*, Zur Kenntnis der Komplexen anorganischen Säuren. VII. (pp. 406-427).

Band xx. Heft 3. *Zeitschrift für Physiologische Chemie.* (15th Dec., 1894.)

Laas, R., Ueber den Einfluss der Fette auf die Ausnützung der Eiweisstoffe (pp. 233-249). *Baisch, R.*, Nachtrag zu der Mittheilung "Ueber die Natur der Kohlehydrate des normalen Harns" (pp. 249-252). *Abel, J. J.*, Ueber das Vorkommen von Aethylsulfid im Hundeharn, über das Verhalten seiner Lösung in concentrirter Schwefelsäure gegen Oxydationsmittel und über einige Reactionen zur Auffindung der Alkylsulfide (pp. 253-279). *Ogden, H. V.*, Ein Fall von Alkaptonurie (pp. 279-287). *Gulewitsch, W.*, Ueber Cadavarin und Cholin aus faulem Pferdefleisch (pp. 287-306). *Schulze, E.*, Ueber das wechselnde Auftreten einiger Krystallinischen Stickstoffverbindungen in den Keimpflanzen und über den Nachweis derselben (pp. 306-327). *Schulze, E.*, Ueber das Vorkommen von Glutamin in grünen Pflanzentheilen (pp. 327-335). *Sundwik, E. E.*, Ueber Uroxansäure und Oxonsäure, Einfache Methode zur Darstellung derselben nebst Analyse einiger ihrer Salze (pp. 335-342). *Winterstein, E.*, Notiz über die Pilzcellulose (p. 342).

Anno 24. Vol. ii. Fascicolo 5. *Gazetta Chimica Italiana.* (10th Dec., 1894.)

Zanetti, C. W., Sul composto del pirrolo con l'acido ferrocianidrico (pp. 373-375). *Peratoner, A.*, e *Genco, A.*, II. Azione del cloruro di solforile sui fenoli e i loro eteri (pp. 375-396). *Zoppellari, I.*, Sulla refrazione atomica del selenio (pp. 396-408). *Werner, A.*, e *Miolati, A.*, Contributo allo studio della costituzione dei composti inorganici (pp. 408-427). *Purgotti, A.*, Sulla riduzione degli amminonitrili (pp. 427-432). *Bartoli, A.*, e *Stracciati, E.*, Sulle correzioni nelle misure di termochimica (pp. 432-437). *Canzoneri, F.*, Ricerche sulla resina di thapsia commerciale (pp. 437-449). *Pesci, L.*, I. Azione dell'acetanili de sopra l'acetato mercurico (pp. 449-453). *Piccinini, A.*, Sulle mercurio-acetanilidi (pp. 453-457). *Piccinini, A.*, Ricerche sui composti organo-mercurici derivati dalle aniline (pp. 457-465). *Pigorini, P.*, Ricerche sulla paramercurio-dietilanilina (pp. 465-468).